COMMODORE USERS

Ahoy!

$2.95/ CAN. $3.35
MARCH 1988



Ahoy!

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VIEW FROM THE BRIDGE

To understand the changes about to occur in *Ahoy!*, visit your local record store. See how much of the floor space that was once devoted to vinyl albums is now occupied by compact discs. If a turntable remains your favorite music-playing hardware, you may be outraged. But the store owner, no matter how eager he is to please you and your fellow record-buyers, wouldn't remain in business long if he catered to your dwindling numbers. His store's future–in fact, its present–is in the new CD technology to which more and more of his customers are upgrading every day.

In the same way, we'd love to keep bringing you C-64 and 128 users *Ahoy!* every month, as it has been our privilege to do for more than four years. But during the past year, two facts have become increasingly clear. Fact one: like it or not, the C-64 and C-128 are headed the way of the vinyl record album--to a sizeable but unexpanding niche. Fact two: the Amiga is destined to do for the home computer market what the CD did for the record industry–revitalize it, expand it, and raise it to levels of quality and achievement never before approached. And here to chronicle it all, four times a year, will be *Ahoy!'s AmigaUser.*

Ahoy!'s AmigaUser

We could have simply increased *Ahoy!'s* amount of Amiga coverage proportionate to 64/128 coverage, but neither Amiga nor 64/128 users would have been happy with half a magazine for their $2.95. By turning *Ahoy!* entirely over to the Amiga on a quarterly basis, no one is forced to pay for a lot of material that's irrelevant to his needs.

Naturally, the many Amiga owners who've written us requesting more space will be pleased–but we have a hunch that many 64 and 128 users will welcome the change as well. We publish so many programs and features per month, we're told, that the average reader can't keep up. With eight C-64/128 issues spread out over a year, many readers can start getting a lot more out of each issue. And of course, the one-third decrease in pages per annum will make us even more selective than before about what goes in. If you've always considered *Ahoy!* the cream of the crop, you'll soon find it to be the cream of the cream!

If you're presently a subscriber, you'll receive only the 64 and 128 issues of *Ahoy!*, spread out over a greater period of time, unless you tell us otherwise. If you'd like to receive all 12 issues, or just the issues of *Ahoy!'s AmigaUser*, write to our subscription service at *Ahoy!*, P.O. Box 341, Mt. Morris, IL 61054-9925 or call 815-734-4151.

The first issue of *Ahoy!'s AmigaUser* will be May, on sale April 5, to be followed by August and November editions. We hope that even the die-hardest 64 and 128 users will pick it up. If nothing you've seen yet has convinced you to upgrade, let *us* try!

We must reiterate that as excited as we are about our Amiga venture, *Ahoy!* for the C-64/128 user will retain, and even raise, its high standards–as is evidenced by the lineup of features in the March *Ahoy!:*

- Dale Rupert helps you put together what the *Rupert Report* has taught you so far about the physics of sound for the purpose of *Synthesizing Waveforms*, or graphically combining simple waves to generate the same waveforms as the Commodore computers. (Turn to page 32.)
- Having torn open, dissected, analyzed, and photographed every other device that can plug into a Commodore, Morton Kevelson had nowhere left to turn except to–the power supply. Actually, the inner workings of that little black box comprise a much-neglected but vital aspect of Commodore computing. When you've finished Morton's double-length feature, you'll finally understand the mysterious cube that gives *Power to the Computer.* (Turn to page 13.)
- Something of a mini-CAD package for the C-64, *3-D Graphic Projector* lets you create, modify, and rotate three-dimensional images on your screen. (Turn to page 41.)
- Especially helpful for ridding telecommunications files of unwanted characters, *The Extractor* allows you to remove lines or groups of lines from any sequential file. (Turn to page 61.)
- After dropping "about $500 worth" of quarters into the coin slot of *Xevious*, Cleve Blakemore knew he'd grow up and get revenge someday. Someday is now, with the arrival of Cleve's *Vee Kloros*, packing a respectable percentage of the arcade classic's excitement into a magazine-length shoot-em-up. (Turn to page 20.)
- As for C-128 gamers, they can share Cleve's midnight *Phantasy* and wander through a nine-screen wraparound maze in search of keys to enable them to open their bedroom door and return to sleep. (Turn to page 18.)

Because this month's special announcement has left us a little short on space, we'll let you explore the rest of this issue alone. Meet us back here in 30 days and we'll tell you how you can win a trip to Paris, courtesy of Firebird and *Ahoy!*

–David Allikas

BONUS PROGRAM!

John Fedor's *Lazer Maze* is one of the finest programs we've ever had the sad duty to reject. It's not that we weren't enthralled by the dual screen action game–it was simply too long to even consider printing.

However, so desirous is John of getting his masterpiece to the audience it was intended for that he's agreed to let us place it on the flip side of this month's *Ahoy! Disk* (see page 23 to order). If you enjoy *Lazer Maze* and would like to recieve two pages of playing tips plus two pages of printed listings for adding new mazes, send a stamped and self addressed envelope and a $1.00 bill to John Fedor, 73 Brook Lane, Lindenhurst, IL 60046.

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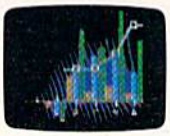
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SPIRITED SOFTWARE

Free Spirit Software has informed us that a number of their programs are being sold without their consent by Keypunch Software, Inc. These games include four of the arcade titles reported on this month—*Pebbles, Alien Panic, Journey,* and *Gladiator*—plus four text games as yet unreleased by Free Spirit—*Yukon, Stalag 23, Shifting Sands,* and *On the Run.* Free Spirit owns the exclusive rights to these programs, which are copyrighted; neither Free Spirit nor the programs' authors gave permission to Keypunch to publish these programs.

Legal action has been filed for damages and an injunction against Keypunch Software. A swift judgment can be expected—so blatant was Keypunch's thievery that they didn't even bother removing the authors' names from the title screens. But in the meantime, the responsibility of every honest software consumer is clear. Buy Free Spirit software from Free Spirit. To make following your conscience easy, until the injunction goes into effect Free Spirit will sell the four arcade games (see GAME RELEASES for description) on one disk for $9.95, and the four text games on one disk for $9.95.

And, as we always do in a case like this, we ask that concerned readers spread the word via users groups and bulletin boards.

Free Spirit Software, Inc., 312-352-7323 (see address list, page 12).

EXPANDED SPECTRUM

Spectrum Electronic Network, the "offline" BBS service on a disk, has added several new SIGs and released a new operating system that supports full color text display and more powerful E-mail editing. As reported in the May 1987 *Scuttlebutt,* the collection of C-64/128 forums, user-written features, and E-mail is sent on disk to subscribers once a month for $6.00. A one-time payment of $16.95 buys the operating system software, support utilities, and the first two monthly disks.

Spectrum Electronic Network (see address list, page 12).

SEIKOSHA PRINTER

With a 100 character per second draft quality mode and a built-in tear bar, Seikosha's SP-185AI printer ($385) is designed for rapid, Telex-type interoffice communication. Other features include a 9-pin print head, 10 inch carriage, and noise level below 52 dBA. The printer is available in serial and parallel versions.

Seikosha America Inc., 201-529-4655 (see address list, page 12).

RECHARGED

Electronic Arts has released two products in its Batteries Included line of C-64 productivity software:

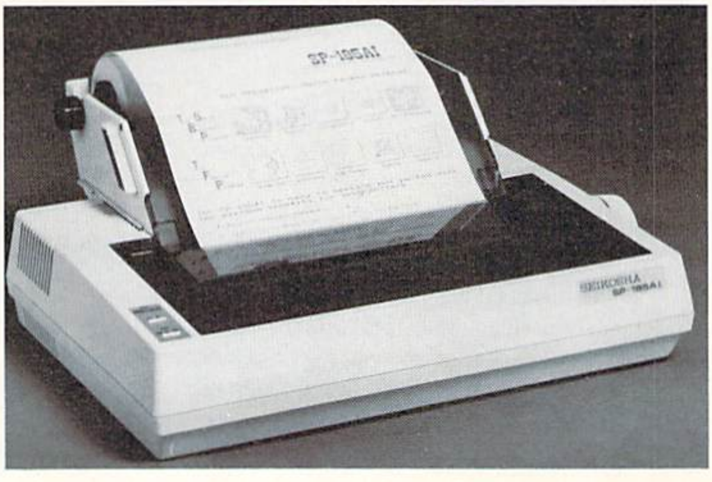
PaperClip III contains all the word processing features of versions *I* and *II,* plus new editing features like Instant Phrases (assign commonly used words or phrases to a specific key) and column editing. Its $49.95 list price also represents a reduction over previous versions.

Outrageous Pages permits the design and layout of newsletters, certificates, and the like, with 50 fonts and 80 different pieces of clip art. Autoflow margins allow the user to wrap text around or within art. A number of templates are included for quick production of coupons, name tags, and other items. The price is $49.95, but until April 1 owners of any other C-64/128 graphics program (*Print Shop, Certificate Maker,* etc.) can send a check for $25 plus $3 shipping, along with the manual cover of their current program, and receive *Outrageous Pages.* Address orders to Electronic Arts, Outrageous Pages Upgrade Offer, P.O. Box 7530, San Mateo, CA 94403.

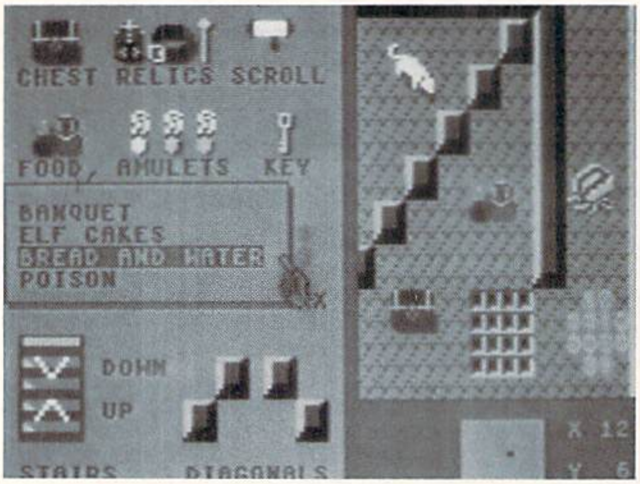
Electronic Arts, 415-571-7171 (see address list, page 12).

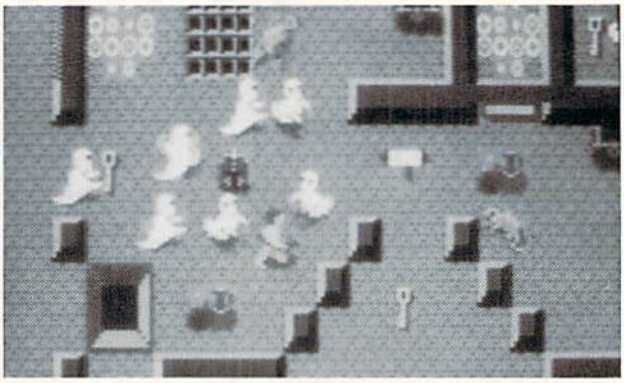
AMIGA ACCOUNTANT

The Amiga version of *The Accountant* offers numerous advantages over the C-128 program, including HELP windows for every input field and 10 check registers including Payroll, all based on a 1 megabyte system. The program also includes Accounts Payable and Payroll check writing, Point-



Seikosha's SP-185AI printer is designed for interoffice communication, with built-in tear bar and 100 cps draft mode. *READER SERVICE NO. 171*





Demon Stalkers: ***100 maze levels, plus construction set. READER SERVICE NO. 170***

of-Sale Invoicing utilizing an Invoice generator, and a batch system for Sales Journals and Purchase Journals.

An Inventory Control and a Cash Register and Inventory System for use with *The Accountant* will be released later in the year. All upgrades will be available to registered owners for postage and handling with membership in the Update Club.

KFS Software, Inc. (see address list, page 12).

GAME RELEASES

Two new C-64 trilogies from Firebird, each $24.95:

Silicon Dreams casts the gamer as a 23rd century colonizer of the planet Eden. The three scenarios are Snowball (on the way to Eden, you are awakened from hibernation by a ship malfunction), Return to Eden (the ship's vengeful crew makes your journey to the Robot City of Enoch hazardous), and Worm in Paradise (solve the problems plaguing the Robot City).

Jewels of Darkness, occurring in the Land of the Demon Lord, consists of Colossal Adventure (rescue elves imprisoned in the Demon Lord's dungeons), Adventure Quest (as an apprentice magician, defeat the Demon Lord), and Dungeon Adventure (after beating the Demon Lord, set out toward glory and greater riches).

Firebird, 201-444-5700 (see address list, page 12).

Six new C-64 releases from Free Spirit:

The graphic adventure *Torchbearer* documents the quest for the Torch of Truth, stolen years ago by an evil wizard and hidden in the Kingdom of Pastoria. Armed with the last of the mysterious luckstones, you'll study magic, increase your strength, and speak with townspeople as you search the island's dungeons and sanctuaries.

In the *Super Bike* motorcycle competition, the rider races the clock in Motocross, Enduro, Supercross, or Trials, steering over and around obstacles like brick walls, logs, and wager holes.

Pebbles requires the player to mine through 18 different playfields, collecting diamonds and avoiding rocks.

To avert *Alien Panic,* the player must trap monsters by digging holes, waiting for the monsters to fall in, and burying them. Contact with the creatures, which carry a deadly virus, must be avoided.

You must guide a spaceship on its *Journey* to the bottom of a cavern while avoiding the defenses built into the walls.

In *Gladiator Combat,* you challenge another player or the computer to a duel to the death. Selection of weapons and armor is a key element: heavier ar-

mor provides more protection but slows the player down, while bigger weapons are more difficult to swing but do greater damage.

Super Bike is priced at $14.95, *Torchbearer* at $29.95, and the other four titles at $9.95 for all four (see SPIRITED SOFTWARE, page 7). Shipping is free.

Free Spirit Software, Inc., 312-352-7323 (see address list, page 12).

Based on the videodisc arcade game, *Dragon's Lair* ($24.95) contains two C-64 adventures on one double-sided disk. In the first, *Dragon's Lair,* you must overcome snapping skulls, fiery chasms, and phantom knights to rescue Princess Daphne from Singe the Dragon. In *Escape from Singe's Castle* deadly boulders and the treacherous Throne Room stand between you and the Lizard King, from whom you must seize a fortune in gold.

Owners of SSI's *President Elect–1988 Edition* can compete for $1,988 in prize money by selecting the winners in 1988's primaries and elections. Entries for the Pre-Primary phase must be postmarked by February 12, and entries for the Campaign phase by October 28. In each phase, the player whose Democratic and Republican candidates come closest to matching the actual election results will win $994. Complete contest rules are packaged with the program, or can be obtained by writing to SSI.

Strategic Simulations Inc., 415-961-6716 (see address list, page 12).

Sherlock: The Riddle of the Crown Jewels ($34.95) casts you as Watson as you work with Sherlock Holmes to find the missing gems in time for the Queen's Jubilee. $34.95 for the C-64; a $39.95 Amiga version with sound will be available in mid-March.

Infocom, 617-492-6000 (see address list, page 12).

Demon Stalkers: The Raid on Doomfane ($29.95) provides action adventure fans with 100 levels of dungeon mazes, plus a construction set for creating unlimited original ones. One or two C-64 gamers must find and battle the demon Calvrak, hiding at the bottom of a 99-level catacomb guarded by rats, snappers, dervishes, mad mages, and ghosts. The menu-driven construction set, containing over 200 design options, permits the creation of dungeon games from scratch, or the modification of any of the existing levels in the game.

Electronic Arts, 415-571-7171 (see address list, page 12).

Two new releases in Epyx's Maxx-Out! line of C-64 software for younger gamers, each $24.95:

Spiderbot concerns three chemical reactors approaching meltdown and the SpiderDroid called upon to defuse them. He must first enlist the aid of creatures roaming the jungle outside the citadel. With that done, he must cope with impassable lasers and electromagnets, and robot guards.

Coil Cop patrols a toy factory where he is the only plaything to survive a takeover by a master computer that is building evil toys. Using a maze of underground pipes, he must collect the pieces of a program that will stop the computer, while avoiding adversaries like Gerald the Gremlin and the Blue Meanie.

Epyx, Inc., 415-366-0606 (see address list, page 12).

WRITTEN IN LISP?

A program that will assist teachers in identifying possible speech or language problems in children, and in communicating effectively with a speech/language specialist, has been developed by Hilltop Speech and Language Services. The C-64 disk contains a speech screening guide, speech/language test request form with parent authorization section, and parents' guide to "10 Ways to Improve Speech Skills at Home." Price is $15.

Hilltop Speech and Language Services (see address list, page 12).

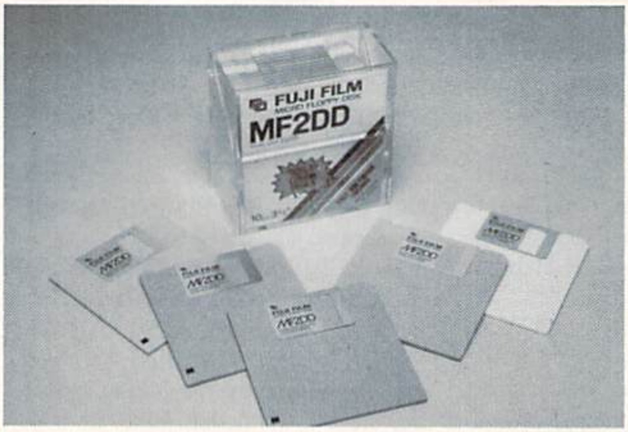
DIVER'S LOG UPDATE

Improvements reflected in Version 1.1 of *The Computer Diver's Log* (see July '87 *Scuttlebutt*) include log search by main activity (photography, spearfishing, etc.) and a checklist generator that allows you to create and store on disk checklists of items to pack for each type of diving you do. Price of the program for the C-64 or C-128 (in 128 mode) is $37.95; CA residents add $2.27 sales tax.

PC Fuel Co., 415-349-9702 (see address list, page 12).

AMIGA EXPANSION

Memory expansion products for the Amiga from Pacific Peripherals:



Fuji's colored 3½" disks come in 10 packs containing two disks each of green, blue, pink, gray, and ivory. Included is a free storage case.
READER SERVICE NO. 190

The Advantage ($199), a 2 meg RAM expansion card for the 500, 1000, and 2000, autoconfigures with Amiga software and permits the user to install inexpensive 256 x 1 dynamic RAM.

The SubSystem ($249) allows 500 and 1000 owners to use cards designed for the 2000 by providing two expansion slots and a space for an optional second floppy drive. The unit, 1½" tall, fits under the 500, raising it to the height of an ordinary typewriter.

OverDrive, a direct memory access SCSI interface for the 500, 1000, and 2000, offers compatibility with Macintosh external storage devices, as well as the ability to add a hard drive inside your Amiga and still use external devices. The card is $249; with a 30 meg external drive, $895; with 50 meg, $1295.

Cage II ($149), a two-slot expansion box for the 1000, uses standard Zorro cards and passes through the 86-pin bus for use with nonstandard applications. Power supply is included.

Pacific Peripherals (see address list, page 12).

DYNACOMP CATALOG

Dynacomp's software catalog No. 32 is now available upon written request, featuring expanded education, business, investment, science/engineering, and public domain sections.

Dynacomp, Inc., 716-671-6160 (see address list, page 12).

BIBLE ON C-128

Landmark, The Computer Reference Bible, is now available in Version 2.0, for the C-128. Like its C-64 predecessor, this version contains the entire text of the King James Bible, but adds a buffer, for a total of three areas in which to store text (main, reference, and buffer). The C-128 and C-64 versions reside on the same disk and utilize the same text files (Bible and Concordance disks). Price of the complete system is $164.95; Version 1.1 owners can upgrade for $10.00.

P.A.V.Y. Software, 314-527-4505 (see address list, page 12).

MUSIC TEACHER

The *Fast Fingers Keyboard Lessons* series ($29.95 each) allows keyboard students to practice their playing with the aid of their C-64's. The screen shows an exercise in musical notation, the location of notes on the keyboard, and which fingers to use. With the aid of a MIDI interface, the prograam can test and grade your performance. Sound is generated by the computer and/or a MIDI keyboard. Volume One covers Major Scales Ascending and Descending, Major Arpeggios, and Major Triads.

Maximum Management, 516-536-0298 (see address list, page 12).

COLORED DISKS

Fuji has released a line of 3½" disks in assorted colors—blue, green, pink, gray, and ivory—designed to facilitate the organization of disks by application or any other criteria. A box of 10 disks includes a plastic storage case.

Fuji Photo Film U.S.A., 800-367-3854 (see address list, page 12).

VIDEO DIGITIZER

Perfect Vision ($219.95) allows the Amiga user to capture an image from a VCR or video camera in 16 gray scales in 1/60 of a second. Color images can be captured from a color or black and white camera using the supplied color wheel. 320 x 200 and 320 x 400 HAM modes are supported, as are 16 and 32 color modes. Files can be saved in IFF format for use in any

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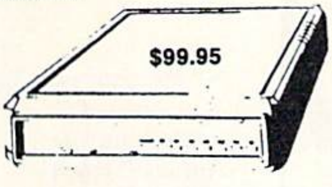
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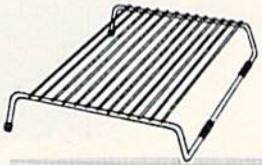
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compatible paint or desktop publishing program.

SunRize Industries, 409-846-1311 (see address list, this page).

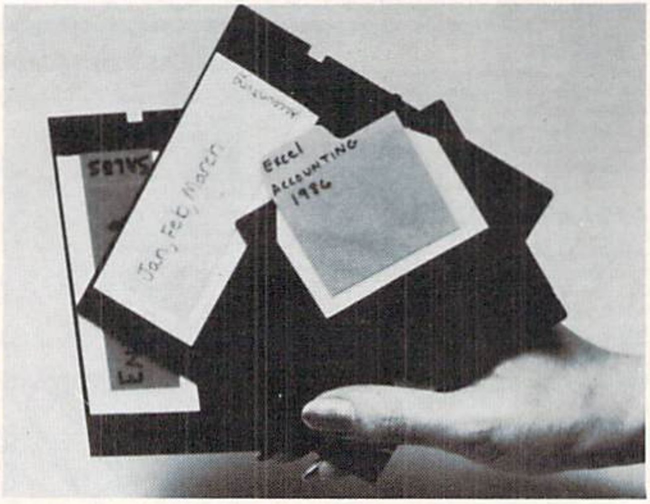
MISSION BOOK

JET: 82 Challenging New Adventures contains 12 chapters of historical aviation scenarios which the C-64 flight fan can recreate with SubLOGIC's *JET* program. Each scenario contains details on aircraft performance, targets, objectives, and weaponry, plus information on events leading up to each battle, guidance through it, screen images of the flight simulator in action, and a debriefing to help players rank their flight results. $12.95 paperback, $19.95 hardcover.

TAB Books Inc., 717-794-2191 (see address list, this page).

DISK POCKETS

The NoLabelSystem eliminates the use of labels on computer disks (and of word breaks in product titles). Instead, a plastic window pocket is affixed to the disk and a card inserted in the pocket. As data on the disk changes, the insert card can be updated or replaced. A set of 100 pockets and cards costs $22.45; or, a starter kit containing 25 of each is available for $6.50. One free sample can be had by writing or calling the manufacturer.



As the data on your disk changes, the NoLabelSystem allows you to keep a written record on the outside of the disk. *READER SERVICE NO. 191*

Weber & Sons, 201-431-1128 or 800-225-0044 (see address list, this page).

AMIGA PIANIST

The *Hotlicks* keyboard player lets Amiga users compose music with the aid of 20 channels for digitized instruments, tape recorder functions for recording scores, built-in metronome and rhythm guides, cut and paste editing of single notes or sections of music, transposition of notes or sections up and down the scale, and onscreen display of the musical keyboard. The program uses 8SVX instruments and SMUS scores, allowing compositions created with it to be played with many other Amiga music applications.

Infinity Software, Inc., 415-420-1551 (see address list, this page).

Companies Mentioned in *Scuttlebutt*

Dynacomp, Inc.
178 Phillips Road
Webster, NY 14580
Phone: 716-671-6160

Electronic Arts
1820 Gateway Drive
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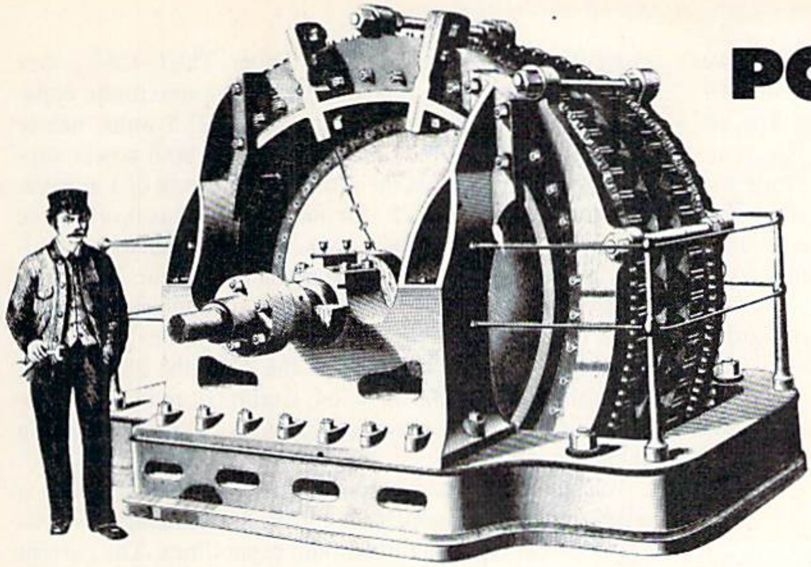
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Panorama City, CA 91412

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Phone: 415-964-1353

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POWER TO THE COMPUTERS

OR, The VIC 20, C-64, Plus/4, C-128, and Amiga 500 Really Get a Charge Out of This

Text and Photos by Morton Kevelson

INTRODUCTION: RATINGS AND SPECIFICATIONS

What do all the machines named above have in common? Among other things, they all have an external power supply. To most of us this power supply is a featureless box with a cable coming out of each end. One cable is fitted with a standard appliance power plug, while the other is terminated in a fitting which is unique to each computer. In all cases the power supply converts the raw, alternating current (AC), high voltage as provided by the local power company, to a form palatable to the computer.

In the ideal case we can ignore the power supply; however, it is not always prudent to do so. The power supply has definite limitations which should not be exceeded. Occasionally the power supply will fail, necessitating a costly replacement. We feel that a better understanding of what these boxes can and cannot do will be beneficial for all.

To start with, we'll examine the markings on our own power supply. You may wish to retrieve your own unit from wherever you have stashed it and follow along at this point. Don't be concerned if the data on your supply does not match ours. Commodore has changed power supply sources on numerous occasions. Looking at one of our C-64 power supplies we see a line which looks something like this:

INPUT : 117V 50/60 Hz 40 VA

This provides the ratings for the source side of the supply. The first number is the nominal line voltage, which in this case is 117 volts. Although it is not explicitly stated, a properly designed supply will tolerate at least a 5% and as much as a 10% voltage variation. This means that the supply voltage should be able to range from as low as 105 volts to as high as 129 volts without any undesirable effects. The 117 volt source is the nominal value for North American users. European users may obtain their electricity at 230 volts.

The second set of figures, 50/60 Hz, represents the allowable range of power line frequencies. Although we have spoken of the source voltage as a constant value, this is not the case. It is constantly changing in a uniform and cyclic manner. The instantaneous source voltage actually ranges from zero to a maximum of 165 volts. The voltage actually reverses polarity 50 times per second in Europe and 60 times per second in North America. The variation is sinusoidal with time and extremely uniform. The local power company goes to great pains to maintain the frequency at a constant value. In fact instantaneous deviations from the proper frequency are measured in fractions of a percent.

Although the power supply is able to operate over a frequency range of 50 to 60 Hz, the computer is set up for one or the other. We will go into this in greater detail below.

The nominal value of 117 volts is mathematically derived by calculating the root of the mean of the square (rms) of the sinusoidally varying voltage over the time it takes to complete a single cycle. The rms value is equivalent to the effective power which can be delivered by a constant (DC) voltage of that value.

The last number on the first line (40 VA) is related to the maximum power or the rate of energy consumption by the power supply. The VA stands for volt-amperes or the product of the input voltage and current. For our purposes we can consider VA synonymous with watts (W), the electrical unit of power or the rate of energy consumption. Watts are what the power company adds up on your monthly electric bill. The figure shown represents a maximum value for this power supply. Normal operation would be at a lower power level.

To find out the maximum costs of operating the computer, simply divide the value in watts or VA by 1000 and multiply the result by the number of hours the computer is on. This figure is the energy consumption of the computer in kilowatt hours. This value is then multiplied by the cost per kilowatt hour in your area to obtain the actual operating cost. Using New York City as an example, where

the cost per kilowatt hour is currently about 15 cents, we find we could leave our C-64 turned on for less than 14.4 cents per day. Most users will pay even less than that, as New York City's electric rates are the highest in the country. Of course the total operating cost should include the energy used by the disk drive, printer, and monitor. You will probably find that the operating cost of the monitor exceeds the combined operating costs of all the other components in your system.

If you have a C-128 you will find a similar set of figures except for the input power rating. On our sample this was 70 VA, nearly double that of the C-64.

The second line on our C-64 sample power supply reads as follows:

OUTPUT : 5VDC 7.5W 9VAC 6.7VA

Our C-128 power supply has an even more cryptic notation which consists of 5V followed by a hieroglyphic which looks like a solid line over a dashed line, followed by 4.3A 9V, a squiggly line, and 1A. All this tells us that both of these power supplies provide direct current (DC) at 5 volts and alternating current (AC) at 9 volts. The five volt output is carefully regulated and free of any significant fluctuations. In the case of the C-64 the 5 volts can supply a maximum power of 7.5 watts which translates to a maximum current of 1.5 amperes to the computer. The C-128's power supply also provides 5 volts DC but at a maximum capacity of 4.3 amperes which translates to 21.5 watts, nearly three times that of the C-64. In addition both power supplies provide 9 volts AC at a maximum current of 1 ampere.

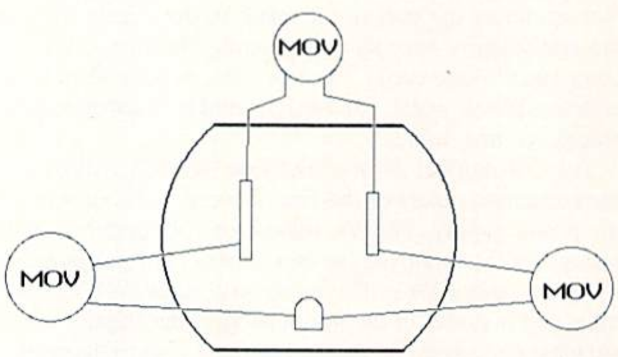
Although the C-128's 5 volt power supply has nearly three times the capacity of the C-64's, the computer uses a proportionally smaller part of the available current. The spare capacity was designed into the supply in anticipation of the extra current which would be needed by the 1750 RAM expansion module. In fact with the 1764, the 256K RAM expansion module for the C-64, Commodore actually provides a replacement power supply with a 2.5 ampere rating at 5 volts DC.

We would like to emphasize that for power supplies it is only the voltages which are constant. The ratings for power or current represent maximum capabilities. The current which is actually delivered by the power supply is determined by the size of the computer, the accessories which are connected to it, and possibly what the computer is doing at the time. A power supply with a particular current rating may always be replaced by another one with a higher current rating. The extra current capacity is simply not used until it is actually needed by the equipment.

Before we go on we would like to mention that the power supply on early models of the VIC 20 was nothing more

ALTERNATE POWER SUPPLIES

Just what are your options when the computer's power supply is no longer capable of performing its duties? The obvious choice is to go to your local Commodore service center and buy a replacement unit. This is certainly a satisfactory solution; however, you will end up with the same thing you had before. We have also found exact replacement power supplies to be a bit pricey.



Power plug MOV connections

If you don't like to get your hands dirty, but want something better than the original, then you might consider a third party replacement power supply (see this issue's *Reviews* section for some options). Third party units usually have a higher rating than the original. Unlike the original Commodore power supply, which is sealed in epoxy, third party units can usually be opened and serviced if required.

If you like to tinker and know something about electronic construction, then for some time, effort, and a minimal investment you can assemble your computer's power supply needs from what is currently available in the "surplus" market.

A while back (Dec. '86 *Ahoy!*) we showed how to assemble a simple 5 volt power supply. That unit was adequate for powering small peripherals, such as a printer interface, but it lacked the capacity to supply current requirements of the entire computer. Here is an alternate solution to the power supply problem.

First check your present power supply. The chances are that it is the 5 volt section which is not working. The 9 volt AC part rarely fails, as it is nothing more than a transformer. If you still have a viable source of 9 volts AC, there is no reason not to use it. If you need a replacement for the entire power supply, you should start looking for a suitable transformer. The 1988 Radio Shack catalog lists an 18 volt, center tapped unit (cat. no. 273-1515, $7.99), rated at 2 amperes. This will provide two 9 volt sources, of which one is simply ignored.

If you're willing to put up with a little clutter, a 5 volt replacement may be easily found. There is presently a glut of "surplus" IBM power supplies in the computer flea markets. The original IBM PCs came with power supplies rated at 65 watts. As the PC's were expanded with additional memory, disk drives, and hard cards, these supplies were found to be inadequate. A booming market developed for replacement supplies, which were typically rated at 135 watts, 150 watts, and most recently 200 watts. Of course once a PC's power supply was upgraded there was no use

than a 9 volt transformer. The conversion to 5 volts DC took place inside the computer itself. In later releases Commodore went to a uniform arrangement where all the power supplies on the 8 bit machines provided 5 volts DC and 9 volts AC. If you are looking at an Amiga 500 you will not find an output of 9 volts AC. You will notice that the Amiga 500 power supply provides +12 volts DC at 1 ampere and −12 volts DC at 0.1 ampere as well as 5 volts DC at 4.3 ampere.

WHERE IT GOES

We will now take a look at how the 5 volt DC and 9 volt AC supplies are utilized inside the C-64 and the C-128. Most of the machine runs off the 5 volt external power supply: in particular the microprocessor, the RAM, the ROM, the SID chip, and all the logic chips which glue the rest of the components together. In addition this same 5 volts is routed to all the external ports for use by add-on peripherals. The 5 volt supply is not available at the serial (disk drive) port and the video port. Thus any accessories which are powered from these ports, such as a printer interface with a wire to the cassette port or the joystick port, will place an additional burden on the external 5 volt supply.

The 9 volt AC supply is utilized in several ways. It is available at the user port for peripherals such as modems and other RS-232 devices. Internally the AC voltage is fed to the CIA chip where it serves as the clock pulse for built-in time of day clocks. These clocks are not used directly by the operating system, but are of interest to programmers.

In the C-64 the 9 volts AC is also converted to a regulated 12 volt DC supply, an unregulated 9 volt DC supply, and a second regulated 5 volt supply. The C-128 does not have this second 5 volt supply. The 9 volts DC is used to power the motor of the cassette recorder.

In the Commodore 64 the 5 volt supply, which is derived from the 9 volts AC, is used to power the computer's clock, the VIC chip and its associated video circuitry. However, the RF modulator, which provides the TV signal, is powered from the external 5 volt supply. This information will prove useful when we diagnose C-64 power supply problems. In the Commodore 128, all of these sections run off the external 5 volt supply.

The only application for the internal 12 volts DC is to the SID chip. An ongoing project at Commodore's semiconductor division is the development of a SID chip which will run off a single 5 volt DC supply, thereby eliminating the need for the 12 volt supply. The latest versions of the SID chip may already utilize the unregulated 9 volt DC supply. Computers with this version of the SID chip may not have the circuitry for the regulated 12 volt supply. This information may prove useful if you ever need to replace the SID chip. □

PC Power Supply Wiring Colors

Color	Voltage
Black	Ground
Red	+5 Volt
White	−5 Volt
Yellow	+12 Volt
Blue	−12 Volt
Orange	Power Good

for the original, still functional unit. At a recent computer flea market we found 65 watt PC power supplies selling for as little as $15.

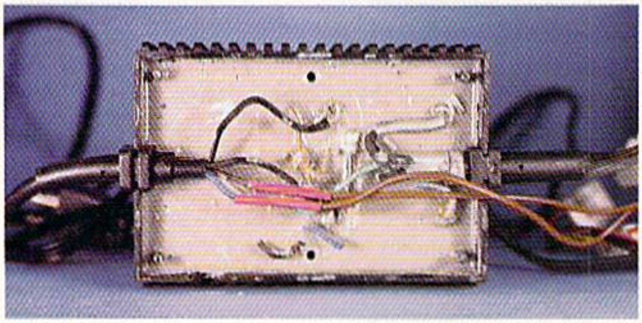
A "surplus" PC power supply looks like a hardware hacker's delight. These are all switching supplies with built-in fans and plenty of capacity for Commodore users. The unit we obtained had four connectors with wires for no fewer than five 5 volt supplies, one −5 volt supply, three 12 volt supplies, and one −12 volt supply. The capacities of the 5 volt lines were either 1.93 amperes or 0.6 amperes. We took a look inside the unit and noticed that all the wires for a single voltage originated from a single source. This gave our unit an effective capacity of 7 amperes at 5 volts, more than enough capacity to run two C-64's and a C-128.

If you examine the business end of a C-64 power supply, you will notice a round plug with four pins in oddly spaced intervals. A close look at the mating jack on the computer shows an industry standard seven pin DIN connector. The sketch on the facing page shows the connections to the power supply plug as seen from its business end. You can use this sketch as a guide for wiring up your own connector.

We took the easy way out by simply using the existing plug and cable on our defunct C-64 power supply. In spite of the epoxy we were able to pry off the bottom cover of our unit. Inside we found enough wire and space to splice in the wires from our PC supply and still be able to reclose the box. An alternative approach would be to carefully cut away the insulation of the C-64's power supply cable and splice in at that point.

On our unit we found a pair of black wires, a brown wire, and a blue wire as shown in the sketch. The black wires we left intact as they carried the 9 volts AC from the C-64's transformer. The brown wire turned out to be the lead for the 5 volt supply, and the blue wire was the corresponding ground connection. Although we suspect that this color code scheme will hold for all C-64 power supplies, we cannot be certain. We advise that you check your own wiring before proceeding.

There remained a single obstacle to overcome before we could get our setup to work. We got no output from our PC supply till we noticed that one of the wires was labled



Inside the C-64's power supply. Our splice to the external 5 volt supply (red heat shrink tubing) is clearly visible. All the components are embedded in epoxy, but a careful examination will reveal a fuse just on the surface.

Power Good. When this wire was connected to one of the 5 volt output leads, everything worked fine. Apparently PC power supplies have a voltage sensor to verify that proper operation. We also noticed that the PC power supply would automatically shut down its output whenever the C-64 was turned off. To reset the supply we had to turn off all power for several seconds.

The color code table on the preceding page will be useful if you intend to tinker with PC power supplies. Once again, these are the colors which we found on the output wires of our unit. We suspect that these are the standard colors adhered to in the PC world.

As with all construction projects, we must warn you to proceed at your own risk. Power line voltages are potentially lethal. A wrong connection on the output can fry the computer. If you have any doubts about your abilities in this regard, we strongly recommend that you stick to commercially finished products. □

ANALOG V. SWITCHING SUPPLY

At present there are two types of power supply designs which are used to provide a regulated DC voltage for use by electronic equipment. Both designs start with a high, unregulated DC voltage and end up with a lower, regulated DC voltage. For the end user, it makes very little difference which design is used. Either approach may be equally effective in providing a regulated source of electrical energy.

The analog design is the older of the two. Its operation consists of the continuous regulation of the output voltage with respect to the input voltage. The advantages of the analog design are a small number of components and a simple and reliable design which may be easily modified for different voltage and power requirements. The disadvantage of the analog design is its low efficiency, which results in bulky and expensive heat dissipating components. In particular, as the power requirements increase, the analog supply needs larger transformers, power transistors, and heat sinks. These tend to get expensive as their size increases.

The switching design was developed to overcome the low efficiency of the traditional analog power supply. The regulating action of the switching design consists of the opening and closing of an electronic switch which briefly permits the passage of an electrical power pulse which maintains the output voltage at a constant value. Since the regulating switch spends most of its time open and drops very little voltage when it is closed, it dissipates less power than the equivalent component in the analog design. As a result the power transformer and the regulating elements in the switching design can be smaller and less expensive than the corresponding components of the analog design for the same output power level.

The disadvantages of the switching design are greater design complexity, increased component count, and a more critical design which cannot be easily modified.

The various economic tradeoffs result in analog designs being used for low power applications where the volume and weight of the power supply are of little consequence. Thus the C-64, C-128, and Amiga 500, which all have low capacity externally encapsulated supplies, use analog designs. The Amiga 1000 and 2000, which have higher capacity, internally mounted power supplies, use switching designs with forced ventilation. From the point of view of the end user the tradeoff is in a possibly lower energy cost in exchange for an initially higher equipment cost. □

SURGE SUPPRESSION

Power line surges or electrical transients are the bane of electronic equipment. These anomalies may be caused by the opening or closing of electrical circuits anywhere on the power system. They may result from natural causes such as a lightning strike on or near a power line, or they may be nothing more than the discharge of static electricity from the human body in contact with the keyboard. Surge voltages are measured in thousands of volts. Fortunately their durations are measured in microseconds or fractions of a microsecond.

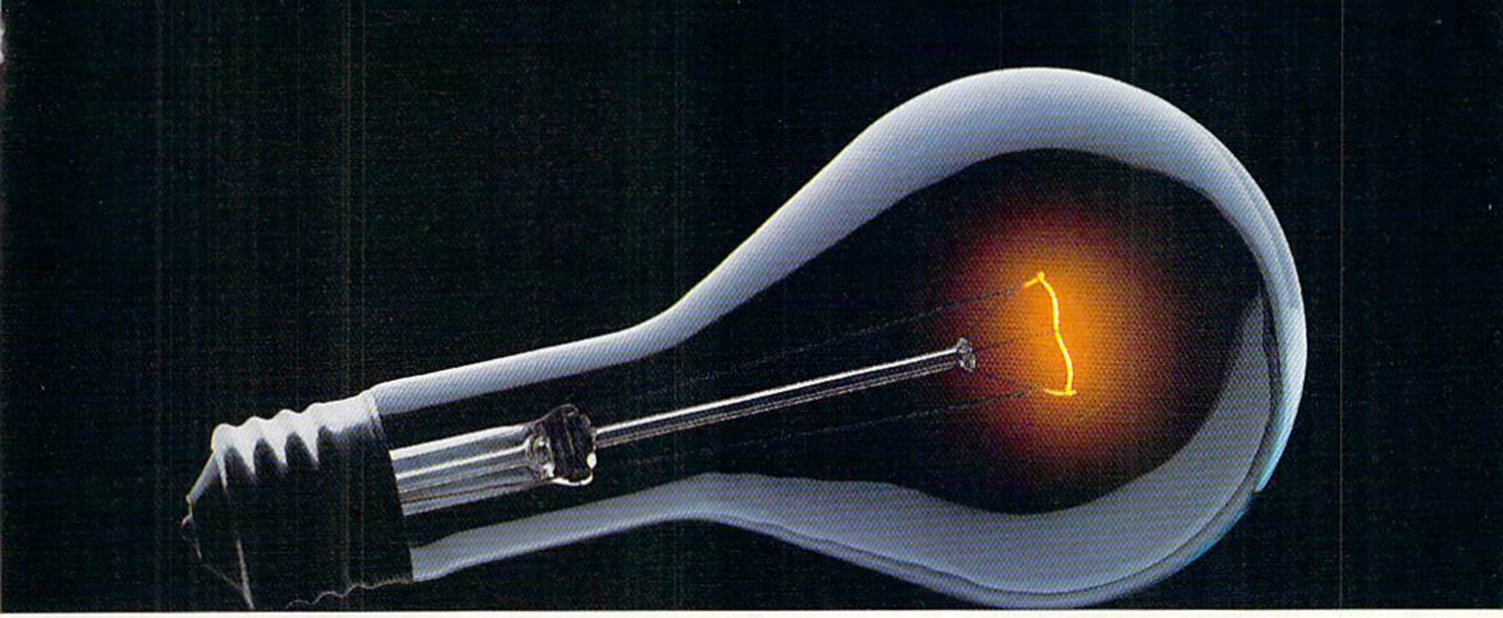
The power line is frequently blamed as the source of damaging electrical transients. Manufacturers and distributors have capitalized upon this concept, as can be seen from numerous surge protected power strips on the market. Power strips which incorporate surge protection cost considerably more than equivalent devices lacking this feature.

The need for power line surge protection is difficult to ascertain. The likelihood of a significant electrical transient finding its way to your computer is strongly linked to the physical configuration of your house wiring and the type of service supplied by your local power company. In general, urban environments, which are usually served by underground systems, are less likely to have problems from surges. On the other hand rural systems, which may consist of long stretches of overhead power lines exposed to lightning, present a greater possibility of damaging transients.

Unfortunately the magnitude or duration of a surge is impossible to predict. Along with this is the lack of agreement on just what may be considered suitable or adequate surge protection. If you are able to do your own electrical maintenance, such as replacing electrical outlets or wall switches, you may be able to install what we feel is a reasonable amount of protection at minimal cost. Keep in mind that power line voltages are potentially lethal. Any equipment which is being worked on should be completely deenergized by pulling its power cord or by opening the branch line's circuit breaker.

The most popular form of surge protection is the metal oxide varistor (MOV). This often takes the form of a 1" diameter disklike device with two electrical connections. The electrical characteristics of this semiconductor device are such that it normally does not influence the circuit to which it is connected. When a voltage which exceeds the protec-

Continued on page 30



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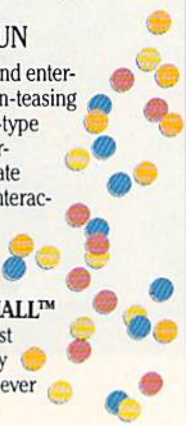
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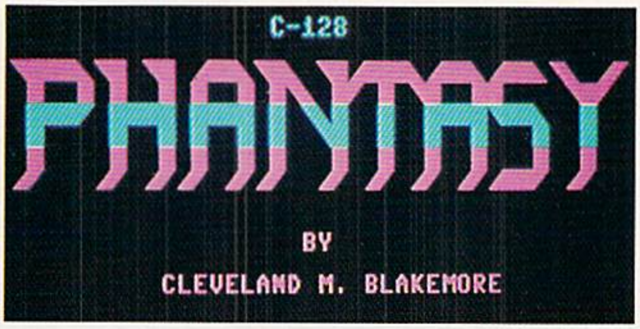
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Have you ever awakened in the middle of the night only to find that you were still dreaming?

In the C-128 game *Phantasy,* you wander through a huge wraparound maze that covers nine screens, trying to locate two keys that will open the doors to your bedroom again.

Avoid the shadowy phantoms that float through the corridors of sleep, who grasp hungrily for you as you explore the maze. If they get their talons on you, you'll never wake up again!

The listing is completely in BASIC 7.0, and requires a joystick in Port 2 to play.

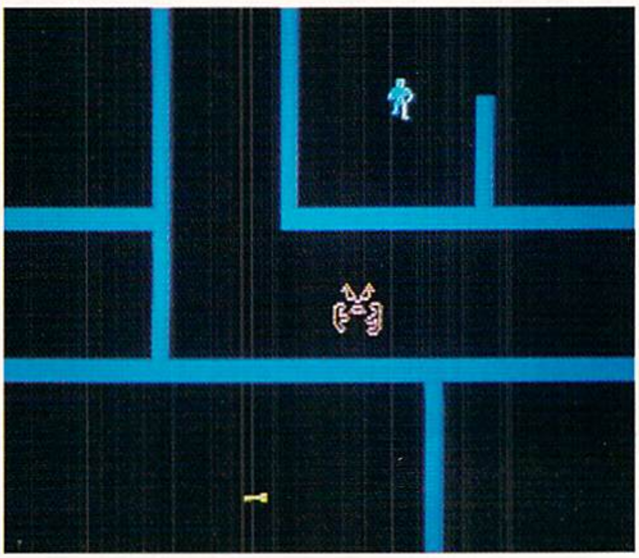
There are five different levels of challenge in *Phantasy,* each more difficult than the last. You can select any level you want from the title screen by moving the joystick left or right. Push the fire button to start the game.

On each succeeding level, the phantoms move faster, and the keys are harder to locate. You'll have to use extremely detailed cunning to get to the keys on the more advanced stages.

Do not enter a new room at an angle in the proximity of a wall! You'll find yourself entombed in solid rock on the other side, at least until the phantoms can pounce on you. Always enter or exit a room in horizontal or vertical directions if you are close to a wall.

Level 5 may drive you mad with frustration, especially when the key is visible but you cannot find the proper entrance. Keep trying. Persistence, patience, and concentration are vital in this nonviolent game.

A complete map of the entire *Phantasy* maze will be published in a future issue of *Ahoy!* Until then, you're on your own! □ *SEE PROGRAM LISTING ON PAGE 86*



PHOTOS: MICHAEL R. DAVILA

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The luminescent screen inside your cockpit blinks for a few moments as the ship's computer navigator searches for an entry on the remote planet you've stumbled across.

There is a bleep, and you gasp in terror as the entry in the log appears on your screen.

V-KLS..V SYSTEM, ORPHEUS CLUSTER
Nicknames: "VEE KLOROS"
"DEATHWORLD"
"THE SILENT ONES"
Galactic Council Status: None
Lifeforms: Highly Intelligent
Silicon Based
Obscure Motivations
Extremely Hostile
Technology: Advanced, Military
Pilot's Instructions:
AVOIDAVOID**AVOID**AVOID**

Your curiosity is even stronger than your fear. Is this the world that explorers speak of in trembling whispers? You cannot resist seeing what lies below the heavy cloud cover.

Your fighter craft descends through the eerie fog with a blast of exhaust, the mystery planet waiting below.

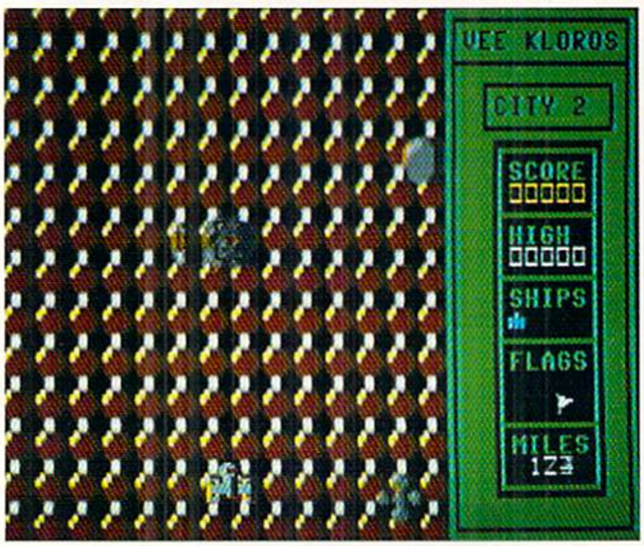
My all-time favorite arcade game has to be *Xevious.* Right about the time most people were getting tired of shoot-em-ups, no matter how graphically interesting, *Xevious* proved that there was always room for improvement. The strange planet was like a golf course designed by Salvador Dali with General Patton in charge of the grounds. The game was rewarding in that you got to view new landscapes and even weirder alien contraptions at work as you progressed, making you work harder to stay alive as you went along.

I often got the feeling that there was some mindboggling conspiracy of xenophobic technology at work in the game, that the aliens were continually preparing more powerful weapons as I moved further into their forbidden regions. This paranoid feeling combined with the bizarre twinkling theme music to create a near Zen trance of concentration. This, plus the fact that the game had a "continue" option if you got killed, kept me in a sweaty hysteria that only closing hour at the arcade could shake me out of.

I must have dropped about five hundred dollars' worth of quarters into that monster.

Luckily, I eventually tired of it. If not, I might be sleeping on a curb with the rest of the joystick junkies instead of working at *Ahoy!*

Vee Kloros is not quite *Xevious,* but I tried to give it as much of the feel and style that I could given the memory limitations of a magazine program. There are five different landscapes that smooth scroll vertically inside a win-





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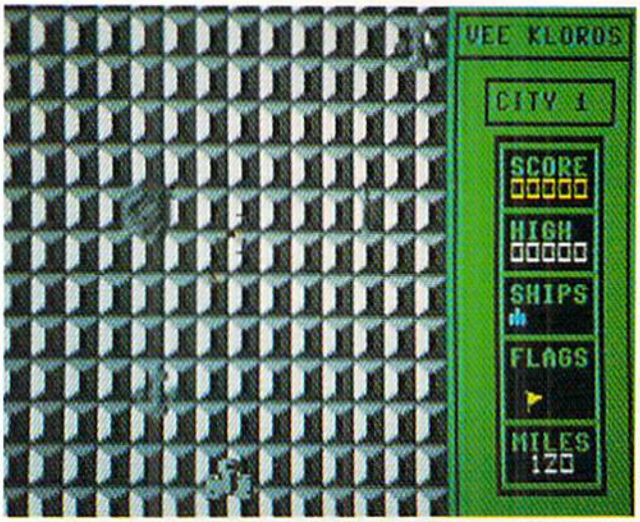


PHOTO: MICHAEL R. DAVILA

dow on your screen (not an easy feat on the 64) and almost 21 separate sprite shapes in the game. I made sure to include spinning toroids that fire glowing wads of plasma, along with a bevy of mysterious alien ground structures and aerial ships. The game even has hidden underwater bases, just like the original.

The game is in two parts, a BASIC program and an object code file. I like hybrids; it's neat to have the ease and advantage of BASIC with the speed of machine language.

The program loads in the object code file, then moves video RAM up to 49152 to make room for all the graphic information. The program has no escape option, so it's wisest to reset the computer when you want to end the game. Plug a good joystick into Port 2 to play.

You'll have the option of starting at any point on the planet you wish by selecting from the five different locations on the title screen. Illuminate the terrain you wish to begin at by moving the stick left or right and press the fire button to start the game.

To blow up a ground structure, center your bombsight directly over it and press the trigger. It will explode and leave a glowing crater in its wake.

Press fire to shoot plasma missiles. The toroids are very difficult to hit, but the alien attack ships are worth more points. The ground structures are worth more points because they are the alien's habitations.

If you manage to go 500 miles across the current landscape, you are awarded a special flag in the box at right to represent a victory over that sector of the alien's terrain. Each time you conquer a sector, the speed of the game picks up and the aliens fire faster and more accurately. Watch out for rearshots! The aliens love to pass you by and then let off with a volley of missiles on your flank.

I have yet to make it through more than eight sectors of terrain. The game gets so quick after that, you will be caught in a crossfire if your attention wavers for even a few milliseconds. As in the original *Xevious,* the interrupt-driven music can send you into a sonambulistic daze.

The machine language code is entered using *Flankspeed.* Make sure the BASIC portion and the machine code file are on the same disk, and that the code file has the correct name before running *Vee Kloros.* ☐

SEE PROGRAM LISTING ON PAGE 77

Ahoy! DISK

Why type in the listings in this month's *Ahoy!* when we've done it for you? All the programs in this issue are available on the current *Ahoy! Disk* for $8.95. Isn't your time worth more than that?

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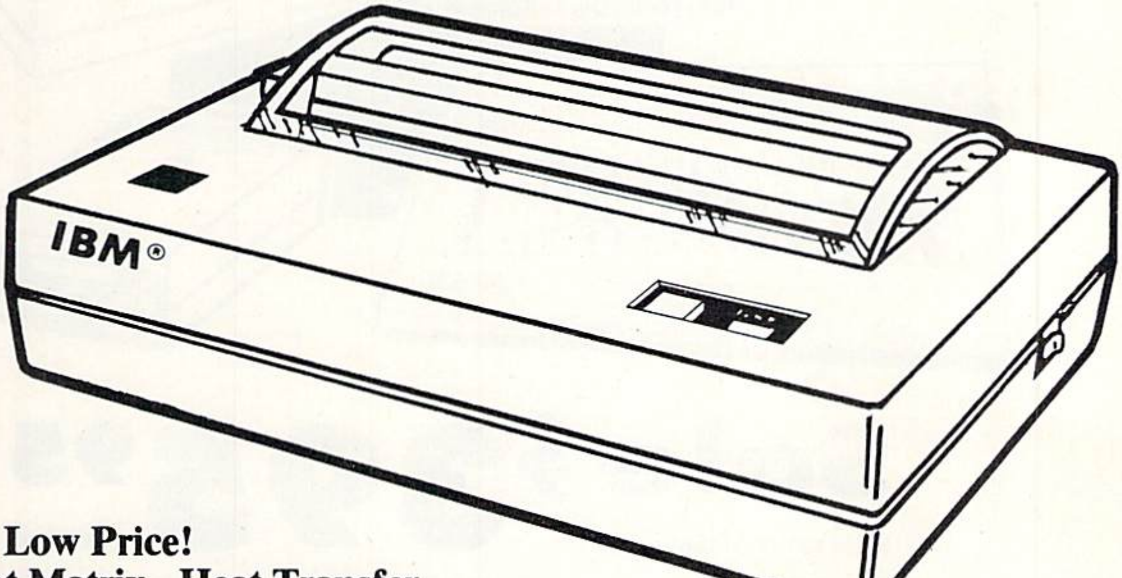
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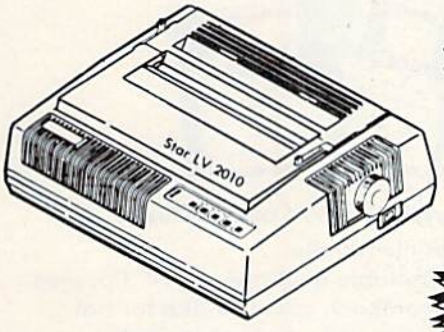
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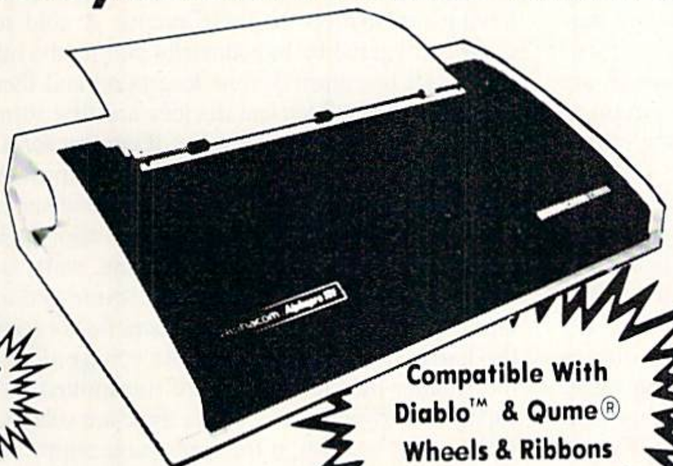
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POWER TO THE COMPUTERS—SURGE SUPPRESSION

Continued from page 16

tive level is applied to a MOV, it becomes an effective short circuit. This has the effect of clamping the incoming surge voltage to the protective level and preventing it from reaching the protected equipment.

Radio Shack stocks what appears to be a suitable MOV as their stock number 276-568B priced at $1.99. Three of these units are required for complete protection. A close examination of the ratings on the Radio Shack device may be useful as a basis of comparison to other devices. First, take note of the maximum operating voltages, which are 130 volts AC or 170 volts DC. The power line circuit to which the device is applied should have an operating voltage less than this.

The next figure (70 joules) indicates the amount of surge energy the MOV can dissipate before it is destroyed and loses its effectiveness. In general, the larger this figure, the more protection the MOV will provide. The maximum and minimum values for varistor voltage for this device are 185 volts and 225 volts. These represent the range of voltages to which this MOV is expected to clamp an incoming surge. Note that the clamp voltages are substantially higher than the operating voltage. Surge protectors, such as MOV's, are not designed to protect against long term power line overvoltages. For example, long term operation of a nominal 117 volt circuit at 140 volts is likely to destroy the MOV and damage your equipment.

The data sheet also indicates that the peak device current is specified at 6500 amperes delivered as a series of eight rectangular pulses each of which has a duration of 20 microseconds for each pulse. These figures actually signify the electrical test sequence which this MOV is expected to pass. There is no guarantee that nature will be so accommodating as to deliver an electrical surge with precisely these characteristics.

A convenient place to install the three MOV's is in the outlet box which supplies the computer and its peripherals. The latest electrical codes require that all outlets be equipped with three prong jacks. One of these prongs carries the line voltage, another is the neutral wire, and the last is the safety ground. Simply connect a MOV across each pair of terminals. The standard color code requires that the line be a black or red wire. The neutral wire should be white. The safety ground may be green or bare copper or aluminum, or it may simply be the metal junction box. If your outlet is equipped with a two prong jack, this may be a good time to replace it with a three prong unit.

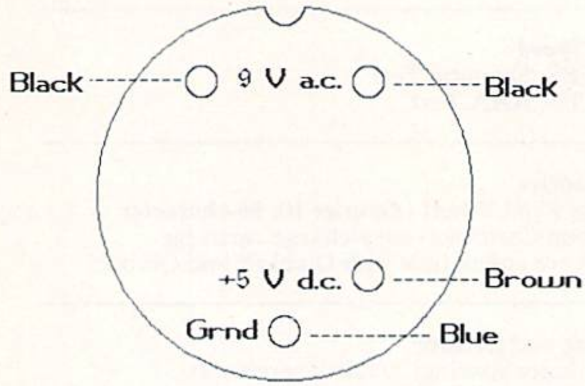
We would like to mention an electrical transient problem we have encountered with the C-64 which has concerned us for some time. We have found that our C-64 would reset itself to the power on state at random intervals. Needless to say, this sort of behavior could be quite frustrating. We were puzzled by the phenomenon till we noticed that it could be induced by switching on the fluorescent light over our desk. Further experimentation identified the disk drive and printer as possible culprits. In particular we found that any appliance with startup current surge could induce the problem.

We also found that electrical proximity of the offending appliance was important. All the devices mentioned above were powered from the same power strip. By reconnecting the devices to an outlet down the wall, we were able to reduce or eliminate the problem.

To verify our suspicions we were able to duplicate these results on two C-64's using four different power supplies. We were pleased to discover that our C-128, SX-64, and Amiga 1000 seemed to be immune to this problem.

Based upon our research we have come up with the following explanation for these events. A cold reset on the C-64 is triggered by momentarily pulling the microprocessor's reset line from 5 volts to ground and then releasing it. When many electrical devices are first turned on they tend to draw a very large pulse of current for a very short interval. This results in a momentary dip in the primary supply voltage. This voltage dip may be observed as a momentary dimming of the lights when a major appliance, such as a refrigerator or washing machine, starts up.

Interestingly enough, the rather severe and long voltage dips caused by these major appliances do not seem to trouble the C-64. It is the much shorter voltage dips, caused by the smaller devices, which are transmitted by the power supply and trigger a reset. Since these are voltage dips which we are dealing with, a transient surge suppressor is of no help. These devices are designed to limit overvoltages and have no effect on voltage dips. The only solution is to power the C-64 from its own outlet. Although this did improve the situation, it did not eliminate the problem. Apparently the short duration voltage dips are able to propagate over the building wiring from other locations.



Plug end view of the C-64's power supply

We have taken the time to present this problem in detail because we feel that many users have encountered it without recognizing the cause. If this information helps you identify the problem, or if you have experienced unexplained resets while running commercial software, please let us know.

We cannot guarantee that surge protection will be the cure-all for power line problems. However, we do feel that a little bit of low cost surge protection can go a long way towards providing peace of mind.

Continued on page 60

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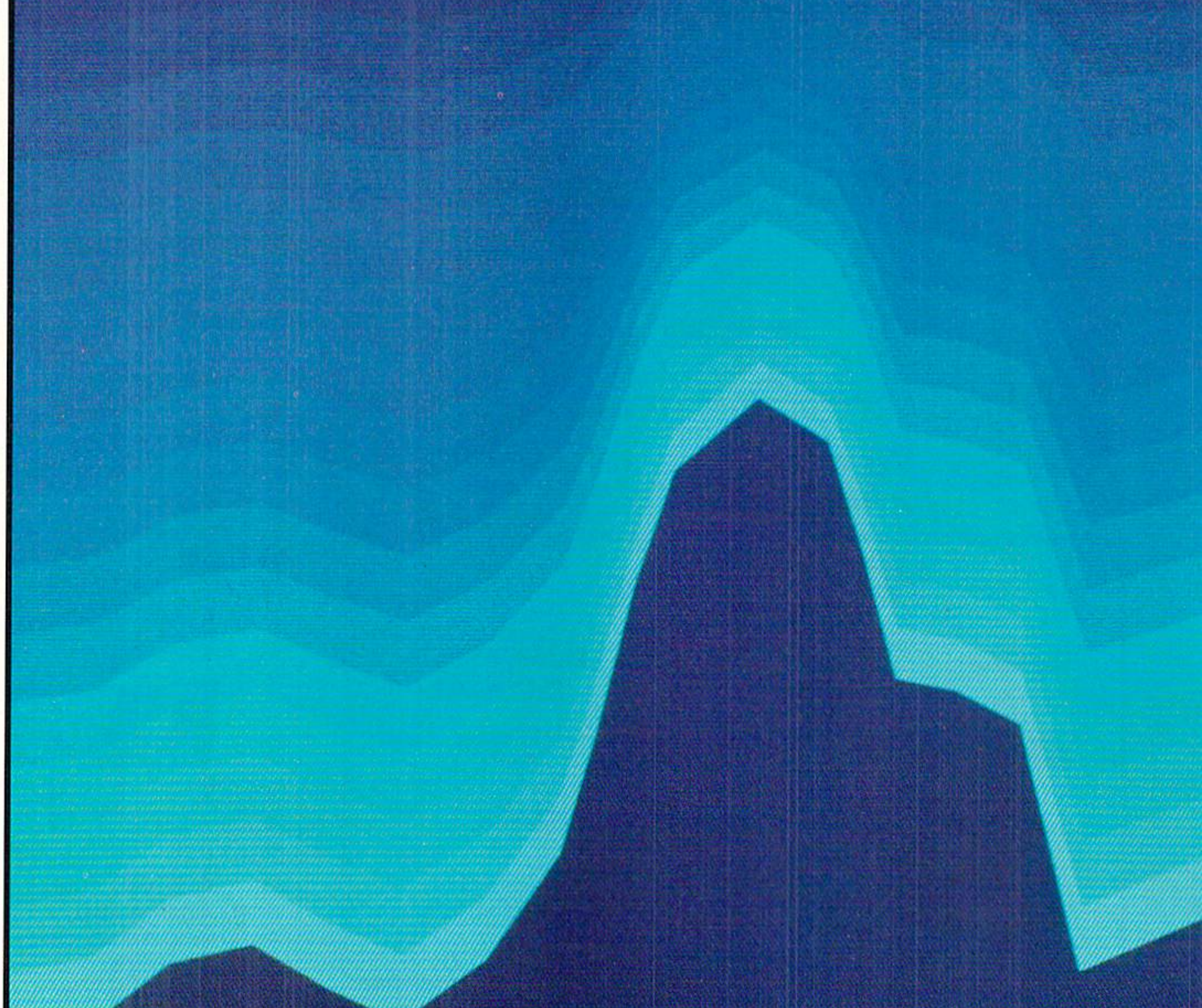
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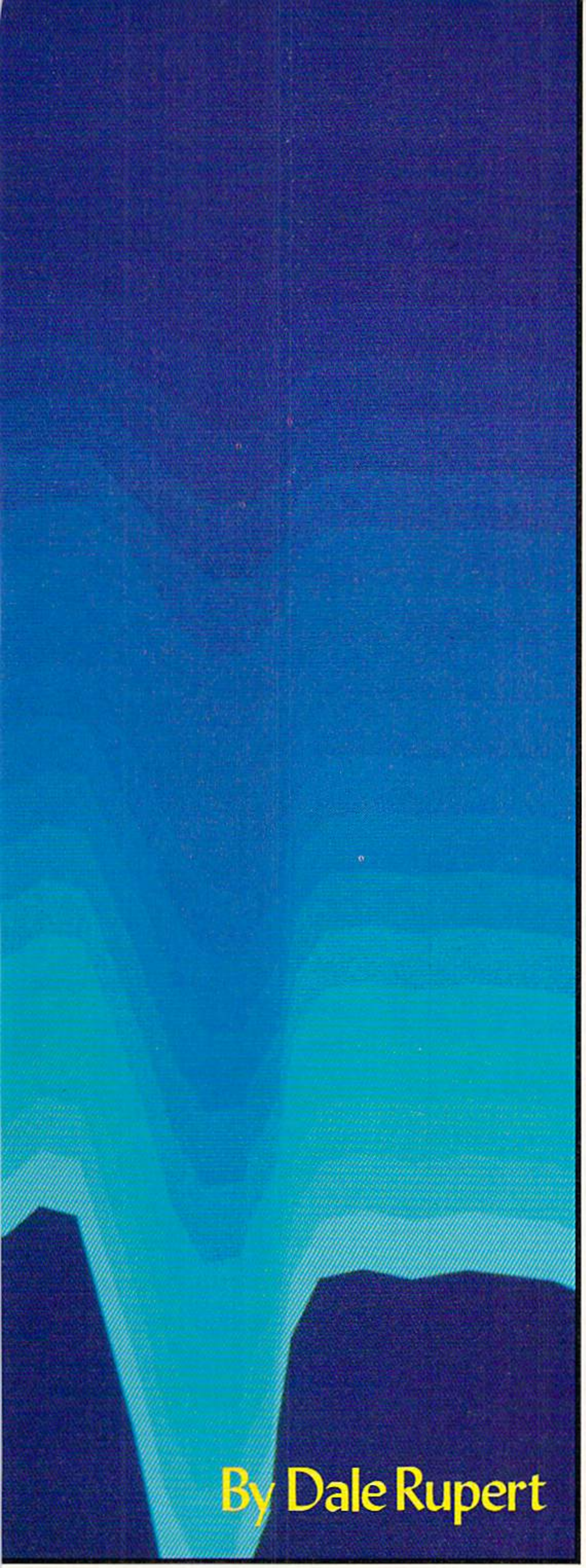
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RUPERT REPORT

In our continuing investigation of sound and wave phenomena, this month we'll talk briefly about the BASIC 7.0 ENVELOPE command and explore two interesting aspects of wave phenomena, beats and Fourier synthesis. These concepts are used in applications from piano tuning to radio communication.

We will graphically combine simple waves to create the standard waveforms generated by the Commodore computers. That is the process of Fourier synthesis. The related process of Fourier analysis gives us an entirely new way of viewing wave phenomena. In our investigation of beats, we will combine sounds of two different frequencies to see (hear, actually) how waves can interfere with each other and cancel each other out. The cancellations produce another frequency known as the beat frequency.

SOME FUNDAMENTALS

Two of the primary characteristics of a sound are its volume and its pitch. The volume is the loudness or intensity of the sound. The pitch is determined by the frequency or repetition rate of the sound wave. More rapid vibrations have higher pitch and sound shriller. Bass tones have a lower frequency or pitch.

Last month we discussed ways to specify the loudness of sounds with the VOL and PLAY commands. We also talked about frequencies of sound as generated by the PLAY and SOUND commands. The difference in sound between a trombone and a saxophone depends upon more than just the volume and pitch of the notes they play. The quality of an instrument's sound, called the timbre, results from the combination of frequencies produced as each note is played.

Middle-C is a note near the middle of the piano's keyboard. Its basic or fundamental frequency is roughly 262 cycles per second or 262 Hertz, written 262 Hz. In addition to the fundamental frequency, sound waves of many other frequencies are produced when middle-C is struck. These other frequencies are called "harmonics."

Generally the volume of each harmonic is less than the volume of the fundamental frequency, but the harmonics are still loud enough to affect the overall sound we hear. If we could watch in slow motion the vibrations of a loudspeaker playing a single note of piano music, we would see a very complicated movement of the speaker cone.

It would be possible to synthesize the sound of middle-C played by a piano by combining many sine waves of the proper frequencies and amplitudes. It would be a difficult task, since the different frequencies do not necessarily all begin vibrating at the same time. (In technical jargon, there are phase differences between them. The various waves are not in phase.)

The way we choose the harmonic content of sounds on the Commodore computers is by specifying one of three standard musical waveforms discussed last month, the triangle wave, the sawtooth wave, and the square wave or pulse. The triangle wave has a harmonic content similar to that of a flute. A plucked instrument such as a guitar produces harmonics which are approximated by a square wave pulse.

THE ENVELOPE PLEASE

Besides harmonic content, another aspect of timbre is the relative amplitude (volume) of the overall sound as a note is played. Middle-C played by a trombone takes some time to reach its full volume (roughly a tenth of a second). The ping of a triangle or other percussion instrument reaches its full volume almost instantly. The rate at which the full volume is reached affects the smoothness or sharpness of a sound.

The ENVELOPE command in BASIC 7.0 provides a convenient way to control the volume of each note being generated, as well as to specify the fundamental waveform. The four volume-affecting parameters of the ENVELOPE command are the Attack, Decay, Sustain, and Release values, known as ADSR.

Attack, Decay, and Release correspond to quantities of time, while Sustain is a measure of volume. The ADSR values may be represented with a graph like the one shown in Figure 1. Keep in mind that this is *not* a frequency or waveform graph as discussed last month. This graph represents the amplitude or volume of a single note as it is played.

Depending upon the time values of A, D, and R, and the fundamental frequency of the wave, the wave may oscillate many times during each portion of the graph. On the other hand, the entire ADSR sequence may be completed before one oscillation of the wave is finished.

Consider middle-C with a frequency of 262 Hz. The amount of time for one cycle of 262 Hz is just the reciprocal of 262 or roughly 0.004 seconds (4 milliseconds). A graph of middle-C played with an Attack value of 24 milliseconds, Decay and Release values of 16 milliseconds, and a Sustain value of 50 percent of peak volume is shown in Figure 2. The length of time spent in the Sustain phase of the graph depends upon the duration of the note. For example, a quarter note played with a TEMPO value of 4.8 lasts for roughly one second. The A, D, and R segments shown in Figure 2 total only 56 milliseconds, so the Sustain phase would last for 944 milliseconds (1000 ms − 56 ms = 944 ms). Only a portion of the Sustain phase is shown in Figure 2.

The VOL command determines the maximum volume reached by the Attack phase of the sound. During the Decay phase, the volume of the sound decreases to the relative value given by Sustain. Clearly the Sustain value can have a more significant effect on the overall volume of a sound than VOL can if the A and D times are much shorter than the total duration of the note. The Sustain value is useful for making one voice louder or softer than another. The VOL command affects all three voices.

Decay and Release times can be as long as 24 seconds. Attack times may be as long as 8 seconds. Several notes may be played during one "Attack cycle" if their duration is short compared with the Attack time. Using long A, D, and R values requires some careful consideration of TEMPO and note duration to get predictable results. A short program discussed later demonstrates this situation.

A chart on page 362 of the *C-128 Programmer's Reference Guide* lists the A, D, and R values and their corresponding times. The values range from 0 to 15. The times for A are from 2 ms (0) to 8 seconds (15). The times for D and R are three times the values for A.

Although there is not an exact formula relating times to A, D, and R values, these formulas give good results:

Attack value = 1.8 * LOG(time) + 11.2
D or R value = 1.8 * LOG(time/3) + 11.2

LOG is the BASIC natural logarithm, and time is in seconds. For example, an Attack time of 400 milliseconds (0.4 seconds) is approximated by using an Attack value of 9 or 10:

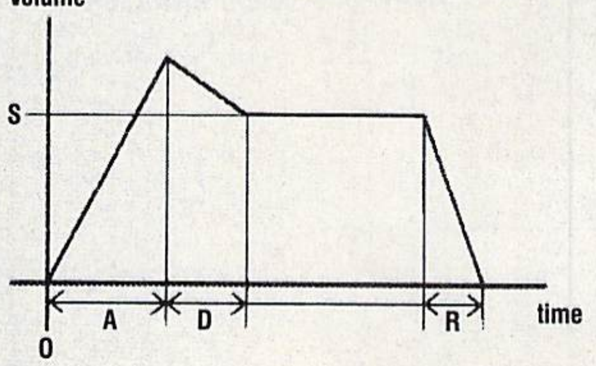
A = 1.8 * LOG(0.400) + 11.2 = 9.6

If you put 9.6 in the BASIC ENVELOPE statement, it will be truncated to 9.

BASIC 7.0 allows ten different envelopes to be defined. The ten envelopes have predefined default values, although you may change any of their parameters with the ENVELOPE command. Each envelope is identified by number (0 through 9). Refer to the *C-128 System Guide* or the *Programmer's Reference Guide* for the default parameters.

Once you have given A, D, S, R, and waveform values for a particular envelope, say number 1, you may use that envelope by putting a "T1" parameter into the PLAY command. The notes following the T1 will be played with the characteristics given by envelope number 1.

Figure 1–Typical ADSR Graph



This program defines envelope 1 to have an Attack time of 8 seconds (A=15), decay time of 48 ms (D=2), sustain level of 3/15 of the maximum volume (S=3), and a release time of 114 ms (R=4). The envelope also specifies waveform 0 which is a triangle wave.

```
10 ENVELOPE 1,15,2,3,4,0
20 PLAY "V1 T1 CDEFGAB"
30 GOTO 20
```

This program repeatedly plays the notes C through B. You will notice that the volume gradually increases for several seconds before dropping back to the initial low volume. In this case, numerous notes are being played during the 8-second attack cycle.

FOURIER SYNTHESIS

We have previously discussed the concept that a sine wave is the simplest, most fundamental type of wave motion. We

also pointed out that all other waveforms can be created by combining sine waves of various frequencies and amplitudes. This process of synthesizing complex waveforms from sine waves is called Fourier Synthesis (pronounced "for-ee-yay").

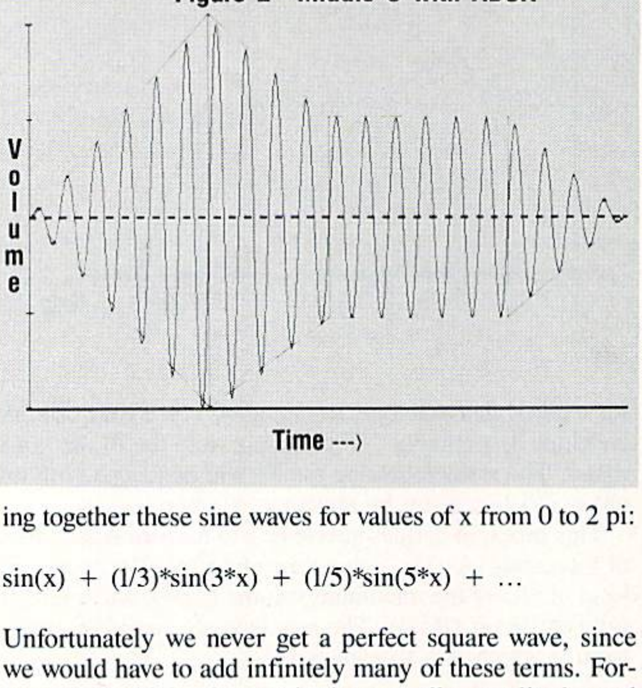
The reverse process, called Fourier analysis, takes a complex waveform and calculates the sine-wave frequencies of which it is composed. The three basic musical waveforms produced by the Commodore computer are the triangle, sawtooth, and square wave, as we saw last month. Fourier analysis of these waveforms tells us precisely how to create them with simple sine waves.

Fourier analysis of a square wave shows that it consists of a fundamental frequency and all the odd harmonics of that fundamental. For example, a 100 Hz square wave can be created by combining a 100 Hz sine wave along with sine waves of 300 Hz, 500 Hz, 700 Hz, and so forth.

Fourier analysis of the square wave also tells us that the amplitudes of the harmonics decrease as the reciprocal of the harmonic number. If the fundamental 100 Hz sine wave has an amplitude of 1, then the amplitudes of the third, fifth, and seventh harmonics are 1/3, 1/5, and 1/7 respectively.

Thus we could create one cycle of a square wave by adding together these sine waves for values of x from 0 to 2 pi:

Figure 2–Middle C with ADSR



sin(x) + (1/3)*sin(3*x) + (1/5)*sin(5*x) + ...

Unfortunately we never get a perfect square wave, since we would have to add infinitely many of these terms. Fortunately the higher harmonics have smaller amplitudes and therefore are not as significant for the overall waveform as the lower harmonics are.

We must add these sine waves point by point. For example, when x is 1.57 (pi/2 = 3.14/2 = 1.57), your computer tells you that sin(x) is 1. Try it. PRINT SIN(1.57) gives a result very close to 1. The third harmonic term for that same value of x is −0.3 (try PRINT SIN(1.57*3)/3). The fifth harmonic gives a value of 0.2 (PRINT SIN(1.57*5)/5). So each higher harmonic has a smaller absolute value than the previous one.

To see that the higher harmonics contribute even less to the sum, calculate the eleventh harmonic term: PRINT SIN (1.57*11)/11. The sine function is never greater than one, so one-eleventh of that must always be less than 0.1.

THEY ALL ADD UP

Adding these sine waves together point by point is clearly a job suited to the computer. Have a look at the program *Waveform Synthesis* on page 76 to see how it can be done. After you specify which type of waveform to synthesize, this program plots a graph of the fundamental frequency sine wave. It then adds the next harmonic term and plots their sum while erasing each of the previously plotted points. It continues this way, plotting the result of adding each harmonic term.

Before your very eyes you can see a sine wave gradually transformed into a "squarish-looking" wave. We can't add infinitely many waves together, and we don't have infinite mathematical precision for the terms we add, but we do end up with a reasonable approximation to a square wave. Graphing of each waveform continues until you press any key, returning you to the main menu.

If we let Fn stand for a sine wave with a frequency which is n times the fundamental frequency (F1 is the fundamental, F2 is twice that frequency, and so forth), the Fourier representation of the triangle, sawtooth, and square waves are as follows:

Triangle: F1 − F3/9 + F5/25 − F7/49 + F9/81 ...
Sawtooth: F1 + F2/2 + F3/3 + F4/4 + F5/5 ...
Square: F1 + F3/3 + F5/5 + F7/7 + F9/9 ...

Notice that the triangle and square waves have only odd-numbered harmonics, whereas the sawtooth includes all harmonics. The amplitudes of the triangle wave terms are inversely related to the square of the term number, and the terms are alternately positive and negative. The amplitudes of the sawtooth and square waves are inversely related to the term number, and are all positive.

THE PROGRAM

The program *Waveform Synthesis* consists of four main routines as shown in lines 20 through 50. The program remains in the Draw Graphs routine at line 200 until the user presses a key to return to the Menu routine. Here is a brief summary of the highlights of the program.

You may change the graph step size in line 10. A smaller value (such as SS = 0.01) may give a higher resolution graph but it takes longer to run. The initialization routine at line 400 predefines the most-frequently used variables. This gives the program some speed advantage. (The first variables defined are found most quickly when the program is executed.)

Line 430 saves the current screen mode so that it can be restored when the program is exited. Line 450 selects the high resolution graphics mode (320 by 200 points).

The graph constants in lines 460 through 520 establish the size of the graphing window on the screen. VL, VR, VT, and VB are the left, right, top, and bottom values of the graphing window. The world coordinates tell the range of values of the functions we are graphing. Our graph will go from 0 to 2 pi horizontally, and range from −1.6 to +1.6 vertically. Lines 510 and 520 calculate scaling factors to fit

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the world coordinates of the graph into the screen viewport.

Three arrays are created in line 540. X0( ) and Y0( ) store the sums of scaled coordinates for each point plotted. On each pass through the graph, all these values are updated. Y( ) stores the actual waveform values before they are scaled for the graph.

The menu routine displays the choices. It uses the WINDOW and PRINT commands to position text on the screen. Putting the final prompt "Select a number" in its own window in line 880 eliminates any concern about the menu scrolling off the screen. The value entered by the user is converted to a waveform number in line 930. An illegal entry by the user is beeped in line 910.

The Draw Axis routine puts the viewport on the screen in line 620. It then draws the horizontal axis which has a Y value of 0 from VL to VR. Line 640 shows how each X,Y value must be scaled before plotting. The corresponding pixels to be drawn are XS and YS. The graph is drawn with larger values of Y at the top of the screen. That is the reason for subtracting from 200 in line 640.

The main part of the program is the DO loop starting at line 230. Harmonic step size HS is given a value of 1 or 2 depending on the type of waveform being synthesized. The sawtooth uses all harmonics, so HS is 1. For the others, HS is 2, giving the odd harmonics. Line 240 calculates K1, the amplitude value to be multiplied by each sine term. It is complicated for the triangle wave as we saw earlier, but simple for the other two. K2 stores the current harmonic value being plotted. It is initially 1.

For FOR-NEXT loop between lines 270 and 350 steps through each horizontal point on the graph. It calculates and adds each harmonic value to the preceding sum at that point. Line 280 clears each value of the Y( ) array when the fundamental frequency is plotted. For all other harmonics, line 280 erases each point on the graph before the new point is plotted. Line 290 calculates the new point by adding the previous value to the next harmonic's value. That sum is saved in Y( ).

Line 310 converts the point into graph coordinates. Line 320 saves those values (so the point can be erased for the next harmonic in line 280). N is an index into the three arrays. It is incremented in line 330. The keyboard is checked. If no keys have been pressed, the FOR-NEXT loop is repeated with the next horizontal value. When the FOR-NEXT loop is completed, line 360 gets the value of the next harmonic to be added, and the process is repeated.

If any key is pressed, line 340 brings the user back to the menu. If the user selects item 4 in the menu to quit, line 920 of the menu routine eliminates the windows on the 40-column text screen and returns to the original screen mode.

If you would like to see the individual harmonics along with their sum on the graph, omit the REM statement from lines 282 through 284. The harmonics are the low-amplitude sine waves along the horizontal axis.

Keep in mind that any waveform can be represented as a collection of simple sine waves. The harmonic content of a waveform refers to the single-frequency sine waves into which it may be separated.

Consider a process just the opposite of what we have done. What is we started with a square wave and began subtracting harmonics from it? By subtracting the right amounts of the proper harmonics, we would end up with a pure sine wave of the fundamental frequency. You could modify *Waveform Synthesis* to do that if you'd like.

This process of subtracting various frequency components from a wave is called "filtering." By filtering the high frequency components from a square wave, we end up with a smooth sounding signal which is characteristic of a sine wave.

Although you generally think of filtering for removing or damping notes beyond a certain frequency range, filtering also affects the harmonic content of every note. The FILTER command in BASIC 7.0 lets you specify the type of filter as well as the range of frequencies which it affects.

GET THE BEAT

We will wrap it up this month with a short program which demonstrates a wave phenomenon called "beats." When two notes of nearly the same frequency are played together, they sound like they are "fighting" each other. The intensity of the sound varies from loud to totally quiet. The rate at which these loud and soft sounds occur is called the "beat frequency." The beat frequency is calculated by taking the difference between the frequencies of the two tones.

For example, if notes of 100 Hz and 103 Hz are played, the beat frequency is 3 Hz. Consequently, three times a second the amplitude of the resulting sound will go from minimum to maximum and back again.

Run the C-128 program *Hear the Beats* on page 76 to experience this phenomenon. The program starts with tones of 290 cycles per second (Hz) and 300 Hz. Initially you will hear 10 beats per second. With each key press, the lower frequency note is raised by 1 Hz. After nine key presses, the difference in frequencies is 1 Hz. At that point, the lower frequency is increased by fractions of 1 Hz. Now you will hear beats less often than one per second.

The "beating" is easiest to discern at beat frequencies below 5 Hz. If you don't recognize the beats at first, press any key a few times to reach a frequency difference of 4 cycles per second. You will definitely hear a 4 cycle per second wavering. Those are the beats.

Line 150 of the program increments the lower frequency by either 1 Hz or a fraction of a cycle per second. The only unusual parts of the program are the POKE statements in lines 190 and 240 through 270. The SOUND commands in lines 80 and 140 start the two notes and give them a duration of 32,000 jiffies (2000 seconds). Whenever a key is pressed, the frequency F2 must be changed. Unfortunately the SOUND command won't accept a new frequency for voice 2 until the current sound is finished, and that may not come for nearly 2000 seconds (over 30 minutes).

Experimenting with the BASIC sound command vectors listed on page 520 of the *Programmer's Reference Guide*, I found that the countdown timer for voice 2's duration is at locations 4739 and 4742. These locations each contain 255 when a sound has been played long enough. BASIC reads the timer values to know when it can start a new sound. Line 190 POKEs 255's into these locations whenever a key is pressed so that the SOUND statement in line 140 can generate a new tone with a higher frequency.

So that you don't have to press RUN STOP/RESTORE

at the end of the program to turn off the sounds, lines 240 and 250 turn off the voice 1 and voice 2 timers. That in itself does not turn off the sound, however. The sound is squelched by putting a zero value into the SID registers for voice 1 and 2 volume control.

Why is it necessary to turn the sound timers off if the volume is already turned off? If you immediately rerun the program, you will find that the sound timers are still counting down from the previous execution of the program, and no new SOUND statements are accepted until the old ones are finished. It looks as though the computer is hung up. In fact it will sit and wait nearly 30 minutes before it can execute the first SOUND command. Pressing RUN STOP/RESTORE resets the timers.

You may make the following changes to the first program, *Waveform Synthesis,* in order to plot two sine waves of similar frequencies:

1. Delete these lines: 30, 180, 210-260, 280-300, 360-370, and 700-910.

2. Add these 3 lines:

```
265 F1=2*PI*20 : F2=2*PI*18
295 Y = SIN(F1*X) + SIN(F2*X)
375 GETKEY K$ : RETURN
```

3. Change these 4 lines:

```
10 SS = 0.001
60 V=4 : GOTO 920
320 DRAW 1,XS,YS
480 WL=0 : WR=1 : WT=2.1 : WB=-2.1
```

Admittedly this is a patch job, but it saves typing a whole new program. The program now displays a graph of a 20 Hz sine wave added point by point to an 18 Hz sine wave. The horizontal axis represents one second of time. The vertical axis is amplitude. You can clearly see the two periods of low amplitude corresponding to the two beats per second.

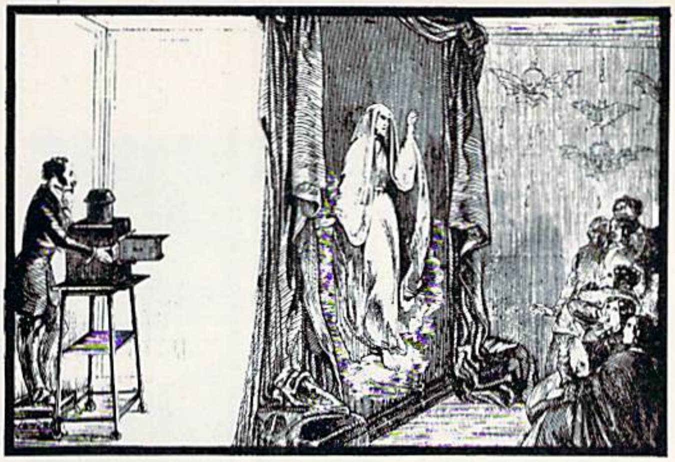
A piano tuner uses beats to tune a piano. A string is purposely detuned, then gradually tightened while the tuner compares its frequency to that of a tuning fork of known frequency. As the string approaches the proper frequency, fewer beats per second are heard. When the frequencies are identical, no beats are heard.

Beats are also used in tuning certain types of radio signals. A radio signal is generated by adding a low frequency voice signal (up to a few thousand cycles per second) to a high frequency "carrier" signal which can be up to several million cycles per second. The frequency of the carrier wave is changing slowly because of the voice signal that is imposed on it.

A radio receiver can "beat" its fixed, high-frequency oscillator with the incoming signal. The result, as we have seen, is just the difference in frequency between the two signals. That difference is simply the voice signal which was used to modify the transmitted signal. A modification of this process called "superheterodyning" is used in radio and television broadcasts today.

There are many other sound and wave phenomena which we can investigate. If you tire of making music with your computer, keep in mind that there is a lot of physics you can explore with it. □

SEE PROGRAM LISTING ON PAGE 76



3-D GRAPHIC PROJECTOR

For the C-64

By Eric Fortier

One of the most interesting aspects of computer graphics concerns the three-dimensional images that the machines can produce; however, due to the relatively small amount of memory most computers have and the speed needed to calculate and plot such images, this is a largely neglected subject.

Great stuff can be accomplished on 8-bit machines in the field of graphics, if the programmer has access to the right software.

It's important that we introduce a few important concepts before I describe the inner workings of my program, in order for you to obtain the maximum benefit from the available commands.

The three most important factors in three-dimensional graphics are the three dimensions themselves, described as the X, Y, and Z coordinate scales. The X axis describes the dimensions of the object in a horizontal direction, the Y axis describes the size in the vertical plane, and the Z axis the "depth" of view.

These three factors can be subjected to a variety of mathematical computations to rotate our objects into many, many different points of reference. These rotations for the X and Y axis are called the Theta and Phi angles respectively. They represent rotations around a central origin point where the three axes meet (theoretically).

That's all the knowledge you need to create and display 3-D pictures with *3-D Graphic Projector.*

After you run the program, you will have to decide on a location for the data used by the system. The default is 16384, but you can make this any safe location in memory. 49152 will work just as well.

You will be greeted by the Main Menu, with several different options available to manipulate your images.

1. Make a picture.

Allows you to create a 3-D image by entering the starting and ending points of the lines of your drawing. You will enter data using sets of four numbers: X, Y, Z, C.

X, Y, and Z are the starting points for our lines. C is a flag that is passed to the program to inform it either to draw a line from the last plotted point (C=1), or to memorize a new starting point without plotting it on the screen (C=0). Always end your data list with a data set that has C=1. Each time you set up a new array of point values with this option in the menu, the previous one is lost.

2. Edit a picture.

You'll be asked if you'd like to see a list of your instructions, the set of points you entered in Option 1. If you want to see that list, press "Y" and the data will scroll by your screen in sets of 48 values at a time. After you view the data, or if you answered "N" to the prompt, you will be returned to the editing menu. Here you can: 1. continue to enter data, 2. continue from a specific number, 3. change a single set of data. All these commands assist you in altering your 3-D image until it looks the way you want it to.

Options 4 and 5 are quite understandable, allowing you to load and save sets of data to disk, so that your precious images won't perish when your computer is turned off.

Option 6 permits you to quit the current session and returns you to BASIC.

When you wish to view your image, the program requires the X and Y extension. With this, you can expand your image in both the X and Y directions at your whim. If you press RETURN here, the program will use default values, which merely represent your image exactly as you entered it when in the editing menu. Next, you must enter Rho, Theta, and Phi. Rho is the distance from which you view the image. The default is 180 degrees. A smaller number will increase the size, while a bigger number will shrink the picture. Theta and Phi are the X and Y viewing angles described earlier. They both default to zero if you hit RETURN.

There is a small ticking sound if all goes well, and the screen will blank. When the computer finishes its processing, it will draw the image on the hi-res screen very quickly.

If you'd like to see a cube for your first image, try entering the following set of data.

```
1) -10, 10,-5,0     9) -10,-10, 5,1
2)  10, 10,-5,1    10) -10, 10, 5,1
3)  10,-10,-5,1    11)  10, 10,-5,0
4) -10,-10,-5,1    12)  10, 10, 5,1
5) -10, 10,-5,1    13)  10,-10, 5,0
6) -10, 10, 5,1    14)  10,-10,-5,1
7)  10, 10, 5,1    15) -10,-10, 5,0
8)  10,-10, 5,1    16) -10,-10,-5,1
```

Try rotating the Theta and Phi. Mess around with the Rho factor. The best way to learn about 3-D is through experimentation. Don't worry about crashing the program. It's almost impossible, and even if the program does crash, you can always just boot it up again. □

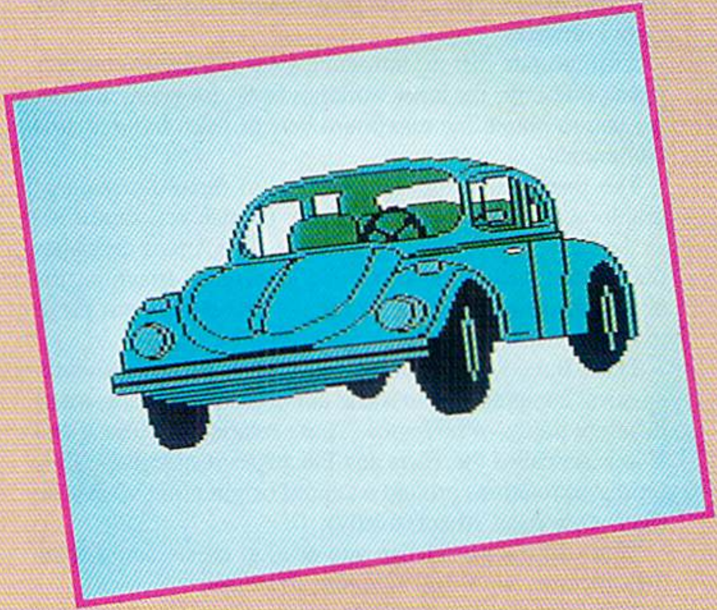
SEE PROGRAM LISTING ON PAGE 82

ART GALLERY



Art Gallery Disk Sale

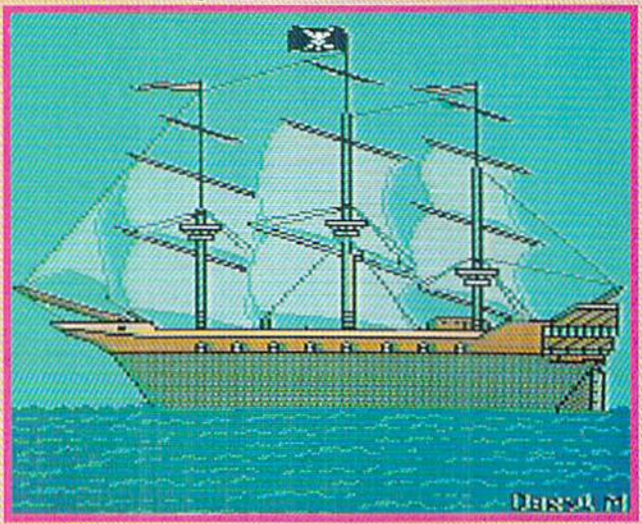
Selected *Art Gallery* images are available on disk. Multicolor images are supplied in *Koala* format, while high-resolution images are in *DOODLE!* format. Included are a slide show for easy viewing, along with a bit map dump for your 1525 printer or properly interfaced equivalent. A sample *Art Gallery* disk with slide show and printer dumps is $10; or send a stamped and self-addressed envelope (business size) for a listing of available *Art Gallery* collection disks. Prices shown are for US and Canada. All others add $3 per disk. New York State residents please add appropriate sales taxes. Disks may be ordered from Morton Kevelson, P.O. Box 290260, Homecrest Station, Brooklyn, NY 11229-0005.

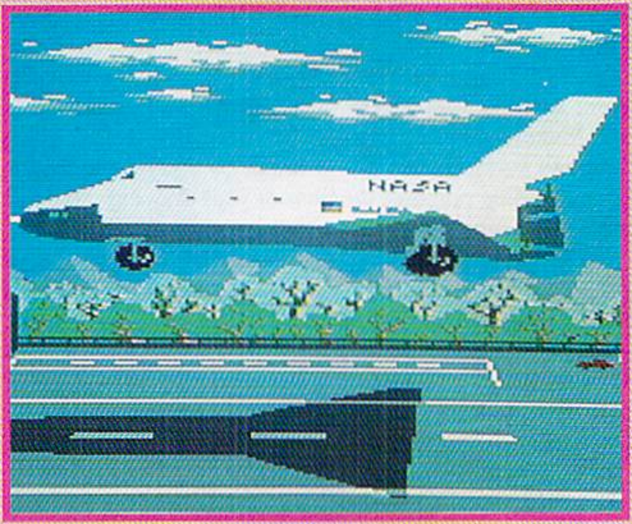


Contribute to Ahoy!'s Art Gallery

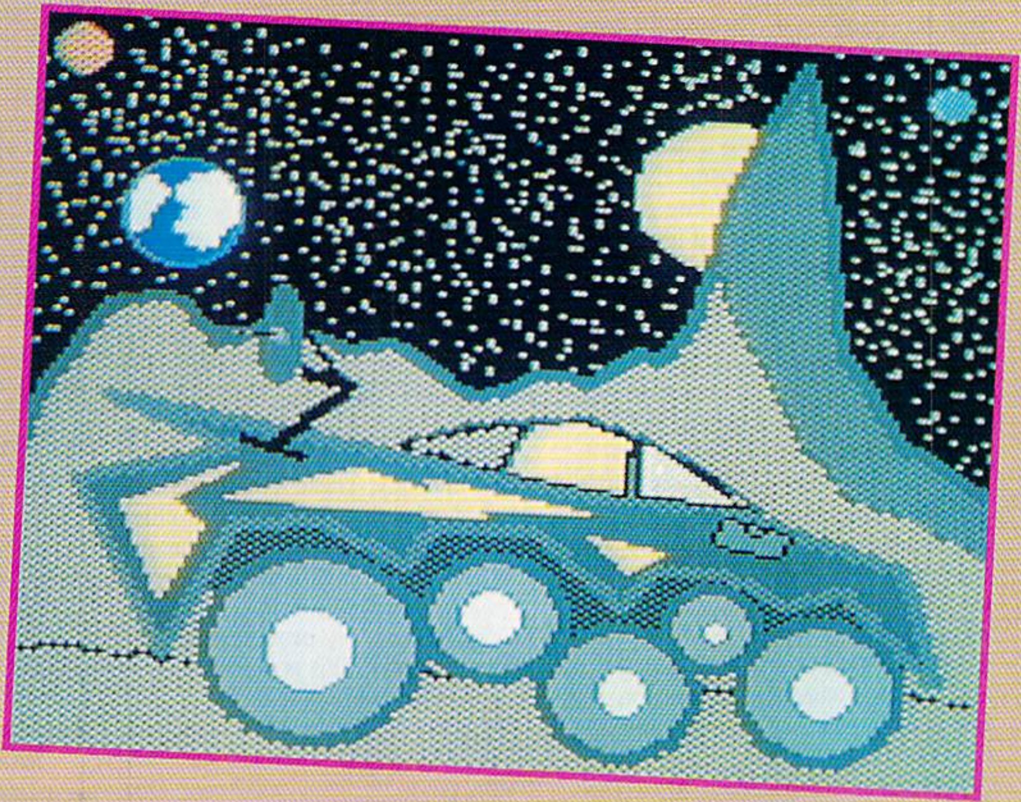
The *Ahoy! Art Gallery* offers the opportunity for fame and fortune to any and all aspiring Commodore artists. Simply send Morton (see address above) your work on disk indicating the drawing package or file format of the images. Inclusion of a self-addressed post card will guarantee an immediate response. All graphics produced on the C-64/C-128, Plus/4, and Amiga computers are eligible. If your image is published, you will receive a free one-year subscription to *Ahoy!* If you are already a subscriber, your subscription will be extended by one year.

Note that the *Art Gallery* is not a contest. Published pictures are selected in an arbitrary and capricious fashion by the *Ahoy!* Art Director based solely on the artistic merit of the individual images.









As is clearly shown by this issue's *Art Gallery* offerings, spaceships aren't the only vehicles that lend themselves to computer illustration. At extreme lower left: *Pirate Ship* by Daryl Maksymec (Regina, Saskatchewan). At immediate left, top to bottom: *Subway,* a token from Michael Montauck (Brooklyn, NY), and *Bug* and *Landing* by Tuyan Vu (Somerville, NJ). On this page, top: it would be tough to catch up to Leonard C. Heinz' (Browns Mills, NJ) *Runaway Train;* and bottom, Barbara Tiess (Middletown, NY) shines on *Moonbeam*. Barbara's image is a *DOODLE!*; for the rest of this month's artists, *Koala* remains the vehicle of choice.



Maniac Mansion *lets the player cursor-select objects from the animation window or inventory and verbs from the menu. The program composes a sentence from these elements. READER SERVICE NO. 147*

MANIAC MANSION
Lucasfilm Games (Activision)
Commodore 64
Disk; $34.95

What do you do when the mysterious Dr. Fred kidnaps your high school sweetheart, Sandy? If you're Dave, the principal hero of this adorable action adventure, you round up a couple of friends and try to rescue her from the Maniac Mansion.

The player begins this joystick-operated game by selecting the kids who will accompany Dave. This is a crucial choice, because each boy and girl has different capabilities. The choice of team members affects both interaction with the mansion's peculiar denizens and the strategy for rescuing the captured cheerleader.

Available characters are Syd, a punk rock musician; Michael, an award-winning photographer for the school newspaper; Wendy, an aspiring novelist; Bernard, the president of the physics club; Razor, the redheaded lead singer of the punk band; and Jeff, who responds to the nickname "Surfer Dude." The player controls Dave when the trio of rescuers huddles just outside the house, but it is easy to switch to one of the others when the need arises.

The game-system, a distant cousin to the one employed in Lucasfilm's *Habitat,* eliminates all typing. The player uses the cursor to select objects from the animation window or inventory and verbs from the menu. The program composes a command sentence from these elements. Pressing the action button when the cursor is on the last word of the order causes the active kid to execute it.

Movement is even easier. After positioning the cursor on the desired destination, the player presses and holds the action button. The kid will walk to the desired destination.

The artwork does not scroll from screen to screen, so the player must move the cursor to the extreme edge of the display to go to the next location. If no obstacle prevents exiting in that direction, the screen darkens. A new picture appears in the animation window after a short delay.

The strength of *Maniac Mansion*, like in most Lucasfilm productions including "Star Wars," lies less in the tale than the telling. The scenario is a fairly standard kids' adventure story, not unlike a Hardy Boys mystery. Meticulous craftsmanship makes the difference. *Maniac Mansion's* characterizations and humor make most other computer adventures seem shallow and hackneyed by comparison.

The command control system is simple to use, but the illusion of depth occasionally falters. Although the artwork shows locations from a side perspective in pseudo 3-D, the characters can seldom move into the foreground or background without immediately entering another room. Generally, this doesn't hurt the game's enjoyability.

Non-interactive animations introduce additional plot elements and build dramatic intensity. These "cut scenes" are very entertaining, and provide clues which help the player penetrate the mystery which enshrouds Dr. Fred.

Maniac Mansion is the best game Lucasfilm has yet produced for the home computer. This is one house party no gamer will want to miss.

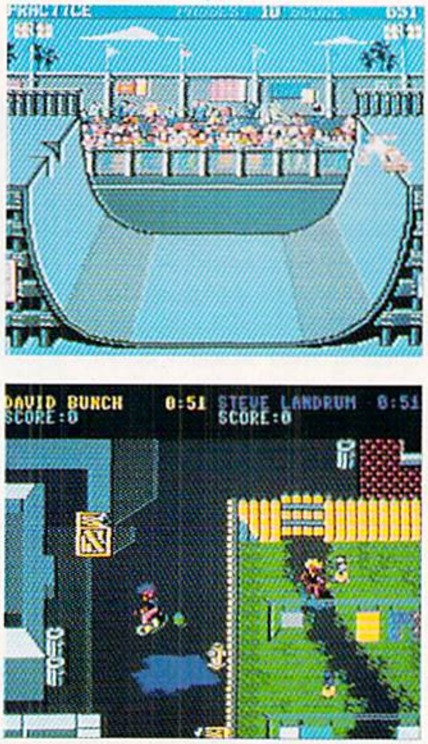
Activision, Drawer 7286, Mountain View, CA 94042 (phone: 415-960-0410). *–Arnie Katz*

SKATE OR DIE
Electronic Arts
Commodore 64
Disk; $29.95

You probably never thought skateboarding would serve as the subject for the most exciting and skillfully programmed action game of the year. Take a few spins through *Skate or Die* and you'll be converted–not to mention astonished (and a little bruised).

Skate or Die lets the user experience the thrills and spills of skateboarding in several different, perfectly realized environments. The action begins when the user acquires a board at the Skate Shop from Rodney, its aging punk proprietor, and decides whether to practice or compete.

The main screen appears, a beautifully rendered, angled overview of the shop and environs. In practice mode, the player can skateboard down any of five streets, each representing a differ-



Skate or Die–*and occasionally both. READER SERVICE NO. 148*

UTILITIES

SUPER 81 UTILITIES

NEW

Super 81 Utilities is a complete utilities package for the 1581 disk drive and C128 computer. Among the many Super 81 Utilities features are:

- Copy whole disks from 1541 or 1571 format to 1581 partitions
- Copy 1541 or 1571 files to 1581 disks
- Copy 1581 files to 1571 disks
- Backup 1581 disks or files with 1 or 2 1581's
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- Supplied on both 3½" and 5¼" diskettes so that it will load on either the 1571 or 1581 drive
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- Perform numerous DOS functions such as rename a disk, rename a file, scratch or unscratch files, lock or unlock files, create auto-boot and much more!

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"...excellent, efficient program that can help you save both money and downtime."

Compute!'s Gazette, Dec., 1987

1541/1571 DRIVE ALIGNMENT

1541/1571 Drive Alignment reports the alignment condition of the disk drive as you perform adjustments. On screen help is available while the program is running. Includes features for speed adjustment and stop adjustment. Complete instruction manual on aligning both 1541 and 1571 drives. Even includes instructions on how to load alignment program when nothing else will load! Works on the C64, SX64, C128 in either 64 or 128 mode, 1541, 1571 in either 1541 or 1571 mode! Autoboots to all modes. Second drive fully supported. Program disk, calibration disk and instruction manual only **34.95!**

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All-purpose utility program for the C64 provides:

- Bi-directional scrolling
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- ML Monitor
- Disassembler
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- Hi-Res Screen Dump
- Number conversion (10, hex, binary)
- Append files
- Restore newed Basic program
- Perform FRE(0)
- Change Device number
- Format — short new/complete new
- Packed Line Editor
- Determine file load address
- Menu-driven
- Change THIS TO THAT — search for all instances of specified string and replace with second specified string
- *And much, much more!*

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GAMES



SUPER BIKE

NEW

Action-packed, fun-filled motor cycle arcade game for the C64. Race the clock in Motocross, Enduro, Supercross or Trials. Fly through the air on spectacular jumps. Bounce over woop-de-doos. Avoid logs, trees, water holes, brick walls, other bikers, etc. as you vie for the gold cup.

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Four text adventures for the C64 on one disk!

YUKON — You are forced to crash land your plane in the wilds of the Yukon. In your struggle against nature, you must acquire five valuable objects and deposit each one at the bank in Dawson.

SHIFTING SANDS — You are stranded in the Sahara desert. You must assemble four valuable objects and carry them to the observatory of Akhnaton. Entering the proper set of magic words wins the game.

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Exciting space exploration game for the C64. Search for life forms among the 200 billion stars in our galaxy. Scientifically accurate. Awesome graphics! For the serious student of astronomy or the casual explorer who wants to boldly go where no man has gone before. Only **$29.95!**

NEW

Torchbearer



Years ago, Talis Vaultheart, a powerful and evil wizard, stole the Torch of Truth and hid it somewhere within the many sanctuaries and dungeons of Pastoria. With the people thus blinded, Vaultheart began to take the land. The time has come to take it back!

The land of Pastoria is a large island with many smaller islands surrounding. You will explore many of them on your quest for the lost torch. Although you start as a common citizen, you are far from common. You possess the last of the mysterious luckstones! Study magic, increase your fighting strength and speak with the townspeople. All this will help you on your quest.

Torchbearer is a challenging, graphic adventure game for the C64. **$29.95.**

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ent event. In competition mode, there's an additional option: an all-event mega-tournament.

At the bottom of the main screen is the downhill area, which, in turn, branches into a straight race and a "Jam" track. The downhill race streaks through a conveniently deserted park, seen from a three-quarters overhead perspective. There are still obstacles—sewer gratings, pebbles, and a small lake—as well as a very inviting construction pipe and several nicely spaced saw horses for stunting.

The jam, on the other hand, takes place in an urban wasteland, creating an inner city event of unparalleled intensity. This time, the player surrogate is an outrageous-looking mohawked punk. The computer-controlled skater, Lester (son of Rodney, the shop owner), boasts similar looks, but his hair is silver rather than blonde.

As the skateboarding sociopaths zip through the back alleys and around the discarded bottles and soda cans that comprise this downhill jam, they can even kick and punch at one another for added spice!

Skate or Die's main screen also contains the access points for the Ramp and Pool. The ramp area is divided into Freestyle and Highjump competitions. The 100-foot long ramp, a U-shaped surface seen from an angled side perspective, is the same for both events. In the Freestyle, the user can try the more conventional ramp-style jumps and maneuvers, while the Highjump is strictly a daredevil affair.

In a game where no contest could be called prosaic, Jousting, the Pool event, is the most bizarre of all. Skateboarders stand at either side of an emptied pool, armed with a "boffing stick" (a shaft padded at both ends). As the instruction booklet puts it: "Two go in, one comes out." The combatants roll down one pool side and up the other, meeting and swatting at each other as they pass. The perspective is similar to that on the ramp events.

Two elements raise *Skate or Die* from the level of a good, exciting game to classic status: the visuals and the play action. The backgrounds and animation are stupendous. Each skater is vividly delineated, instantly recognizable down to the last detail. Every stumble and tumble is perfectly choreographed; each turn and flip gracefully reproduced.

The skating surfaces, especially in the downhill events, are richly illustrated. When a skater does a header into the park lake in the downhill race, the resulting animation is a delight. So is the sequence on the jam when a skateboarder drops down an open manhole.

The play action, always crucial in a game of this type, is amazingly precise and responsive. A skilled user will be able to control the most subtle twists and maneuvers ever seen in a computer game.

Skate or Die is a certified winner. So head on down to Rodney's Skate Shop and prepare to skate—and, occasionally, die.

Electronic Arts, 1820 Gateway Dr., San Mateo, CA 94404 (phone: 415-571-7171). —***Bill Kunkel***

RAD WARRIOR
Epyx
Commodore 64
Disk; $24.95

This premier offering in Epyx's "Maxx Out" series of arcade action games boasts utterly superb graphics, terrific music, and sound effects that are well-conceived for the eerie post-nuclear world in which the game takes place. The science fiction setting of *Rad Warrior* is both believable and chillingly spooky, full of extremely detailed sprites and scenery.

With an opening like that, you'd probably expect a recommendation, and I wish I could give it. However, the game has certain crucial flaws that are unforgivable considering the quality of software we have come to expect for the 64.

The object of the game is to find and arm an ancient electronic suit of armor which the player then uses to wipe out the bad guys—a solid idea. It suffered somewhat in the translation.

The game's worst flaw concerns the creatures in the rooms through which the player wanders in search of the armored suit. You can kill them umpteen times in the game—but leave the room and come back, and you'll find them all mysteriously resurrected, like *Pac-Man* ghosts. This absence of logic interfered with my effort to suspend disbelief and become engrossed in the world that *Rad Warrior* was trying to create. If the information for each room were updated when a monster was killed, or if a reason were offered for this spontaneous regeneration (e.g., a "monster creator"), both consistency and the player's sense of accomplishment would have been boosted.

A warning about playability: *Rad Warrior* was far too difficult for me, given the absence of a "save" feature. Merely powering up the suit of armor and taking off requires more patience and less real problem-solving than most veteran gamers will exert (though it must be remembered that the "Maxx Out" series is targeted toward the younger player). I found myself bored once the charm of the appearance and sound wore off. This is a perfect example of programmers failing to balance challenge correctly with rewards in order to addict the player to the game.

The documentation is sparse, misleading, and often irrelevant to actual gameplay. There is no excuse in the current-day software market for this sort of "last night before disk duplication" type of documentation that was common a few years ago. The map on the last page is the only part of the documentation likely to be of any use at all.

Rad Warrior demonstrated potential from the moment it booted up, but the negative aspects of the game are too significant to ignore. If you have patience enough to carry it through to completion, *Rad Warrior* may prove to be satisfying entertainment.

Epyx, Inc., 600 Galveston Drive, Redwood City, CA 94063 (phone: 415-366-0606). —***Cleveland M. Blakemore***

ECHELON
Access Software
Commodore 64
Disk; $44.95

Echelon is the most talked-about new game in the Commodore universe, a superb science fiction flight simulator with combat elements and a technical innovation that really works: Access's "LipStik." Designers Brent Erickson and Roger and Bruce Carver have created a viable sf experience that marries high concept with high tech.

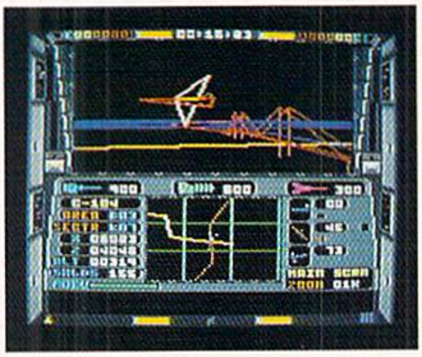
Echelon is the code name for a top secret military facility located on the planet Isis. It was established by the International Space Federation to deal with the growing threat of space piracy on mining and shipping operations.

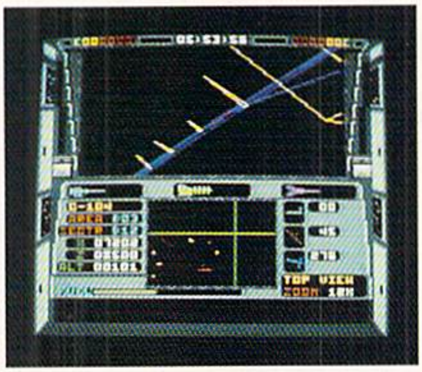
The user has qualified for assignment to this glory post and will fly the 21st century's most sophisticated combat spacecraft, the C-104 Light Cruiser, a.k.a. Tomahawk.

Three types of missions are available to the player: Scientific, Patrol, and Military. Scientific missions are for exploration and information gathering, military forays result in near-constant combat, and patrols integrate the two types into a more realistic operation.

Patrol Zones are 840 square kilometer regions of Isis comprising 36 subregions, called Areas. An Area is 140 km square and is, in turn, subdivided into 196 Sectors, each 10,000 meters square. The Tomahawk departs from a Base Station to explore this territory and must periodically return for fuel, repairs, and ammunition.

Echelon has the right stuff for a flight simulator: it is reasonably simple to learn (especially with the help of a keyboard overlay), yet offers enough sophistication to qualify the Tomahawk as a genuine "dream ship." The panel offers a range of super-weapons, flight aids, and data access, such as maps, tracking, and a link with Base Station.





Echelon *boasts vectorlike 3D graphics.*
READER SERVICE NO. 149

Combat is especially satisfying because of the game's superior graphics and the integration into the game of the LipStik, a voice-actuated secondary action button. Because so many game commands are assigned to the keyboard and joystick, it is very difficult to manually access the fire command key (space bar). Enter the LipStik. As the player logs on, he dons the LipStik —a padded, Walkman-style headmount with attached microphone—and conducts voice tests. Thereafter, in patrol or military modes, missiles and other weaponry can be launched by simply speaking the word "fire."

Echelon boasts excellent visuals rendered in a pseudo-vector graphic style, giving objects a three-dimensional, almost crystalline look. The lines are a little ragged in places, but this visual style makes up for it with its vividness and detail.

Echelon is an exciting, state-of-the-art entertainment for all fans of flight simulators, science fiction, and action combat games.

Access Software, 2561 South 1560 West, Woods Cross, UT 84087 (phone: 801-298-9077). *—Bill Kunkel*

TIPS AHOY!

Compiled by Michael R. Davila

Contributors to *Tips Ahoy!* will be compensated at highly competitive industry rates. Send your best programming and hardware hints for the C-64, C-128, or Amiga to *Tips Ahoy!*, c/o Ion International Inc., 45 W. 34th St.–Suite 500, New York, NY 10001. Include a stamped and self-addressed envelope if you want your submissions returned.

GETTING BASIC 7.0 TO RUN IN C-64 MODE

When the need arises to run your programs written in C-128 native mode in the C-64 mode, or simply to make your programs 64/128 compatible, include the following to detect the operating mode and automatically provide for uninterrupted execution:

```
100 MO=PEEK(53533):REM MODE CONFIG REG
110 IF MO=55 THEN PRINT"RELEASE 40/80 KE
Y"
120 IF MO<55 THEN 200:REM C-64 MODE
130 REM ** LINES FOR BASIC 7.0 **
.
.
.
200 REM ** RESUME COMMON BASIC **
```

Alternatively, depending on construct desired, repeat lines 100 and 110 and change 120 and 130 to:

```
120 IF MO=183 THEN... do BASIC 7.0
130 REM ** RESUME COMMON BASIC **
```

–Edmund G. daSilva
Rio de Janeiro, Brazil

QUICK BYTE COUNT

This short machine language routine will give you a quick and accurate count of bytes in a program or sequential disk file–about 1500 bytes per second with a C-128 and a 1571 drive, 595 bps with the C-64 and a 1541. –Bert Halverson
Muldrow, OK

```
•5 PRINTCHR$(147)"BYTE COUNTER":PRINT
•10 GOSUB45
•15 POKE 2900,0:POKE 2901,0
•20 INPUT"FILE NAME";N$
•25 OPEN2,8,2,"0:"+N$:OPEN1,8,15:INPUT#1,
 E:IF E=0 THEN 35
•30 CLOSE2:CLOSE1:PRINT"NOT FOUND":END
•35 SYS 2816
•40 PRINTPEEK(2900)+256*PEEK(2901)"BYTES"
 :CLOSE2:CLOSE1:END
•45 FOR X= 2816 TO 2848
•50 READ A:POKE X,A:C=C+A
•55 NEXT:IF C=4707 THEN RETURN
•60 PRINT"ERROR IN DATA STATEMENTS":END
•65 DATA 32,204,255,162,2,32
•70 DATA 198,255,32,207,255,238
•75 DATA 84,11,208,3,238,85
•80 DATA 11,165,144,201,64,208
•85 DATA 239,32,204,255,96,32
•90 DATA 204,255,96
```

DISCOVER

Ever find yourself wanting to check the names and ID's of your disks? Maybe you finally decided to label that incredible mass of square frisbees. Or, if you can just find the right disk, you can continue working on that soon-to-be masterpiece. Well, you can spend the next decade loading each disk to check its name. But if you want to cut that time and effort down to mere minutes, try *Discover.* A quick SYS returns the name and ID of any disk in your drive. It works with the C-64 and C-128 using a 1541 or 1571 disk drive. It won't erase or disturb anything in memory.

Discover is fully relocatable by changing the variable S in line 1. It's currently set for location 700 on the C-64. If you're using a C-128 in C-128 mode, be sure to change S to 3072 or 4864 or some other compatible location.

–Buck Childress
Salem, OR

```
•1 S=700:REM *** CHANGE S TO RELOCATE
•2 PRINTCHR$(147)"LOADING";:FORJ=STOS+56
•3 READA:POKEJ,A:X=X+A:PRINT".";:NEXTJ:PR
 INT:PRINT
•4 IFX<>8392THENPRINT"ERROR IN DATA[3"."]
 ":END
•5 PRINT"DATA OK * SYS"S"TO ACTIVATE[3"."
 ]":END
•6 DATA169,36,133,251,169,5,162,8,160,0,3
 2,186
•7 DATA255,169,1,162,251,160,0,32,189,255
 ,32,192
•8 DATA255,162,5,134,252,32,198,255,32,20
 7,255,198
•9 DATA252,16,249,32,207,255,240,5,32,210
 ,255,208
•10 DATA246,32,204,255,169,5,76,195,255
```

C-128 ARCHES

This is one of those "picture is worth a thousand words" type programs, that is easier to type in and run than to explain. Basically, it will produce an almost unlimited number of fascinating hi-res screens composed of archlike structures. There isn't much more to say about it, except that it's a worthy candidate for the Maximum-effect-with-the-least-number-of-lines Award. Even if you're used to the versatility of BASIC 7.0, I think you'll be a little surprised by

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the product of these three simple lines.

```
10 I=RND(-TI):COLOR1,1:COLOR2,2:COLOR0,1
2:COLOR4,12:GRAPHIC3,1:BOX2,0,0,6,8,0,1:
BOX1,0,0,6,8:SSHAPEB$,0,0,6,8
20 DO:C=.:GRAPHIC3,1:X=INT(RND(1)*7+1.5)
:Y=INT(RND(1)*9+1.5):X=X-2*(X=1):Y=Y-2*(
Y=1):X=X-(X=Y)
30 C=C+1:X1=77+61.5*SIN(X*I):Y1=96+77*CO
S(Y*I):I=I+.01:GSHAPE B$,X1,Y1:IFC<700TH
EN30:ELSESLEEP2:LOOP
```

Should you start to get bored with this (it will take a while), try altering the COLOR values in line 10 to achieve different results.

Now aren't you glad you bought a 128? –Jon Mattson
Castlegar, BC

GETTING COLORS

GETting Colors is a short machine language program for the C-64 and C-128 that enhances your BASIC programs. This program sets up an interrupt that redirects the computer's execution to this routine whenever GET or GETKEY are used. When either statement is encountered in your program, the border will change colors to signify that the computer is waiting for a response from the keyboard. To relocate the routine, simply change the value for variable S in line 20 to any area of free memory. –Michael Jaecks
Alamogordo, NM

```
10 REM GETTING COLORS
20 S=4864
30 FORI=0TO47:READA:POKES+I,A:B=B+A:NEXT
I
40 IFB<>4710THENPRINT"ERROR IN ML DATA!"
:END
50 DEFFNHI(X)=INT(X/256):DEFFNLO(X)=X-FN
HI(X)*256
60 FORI=1TO4:READA,B,C:POKES+A,FNLO(S+B)
:A=A+C:POKES+A,FNHI(S+B):NEXTI
70 PRINT:PRINT"SYS"S"TO ACTIVATE"
80 PRINT:PRINT"HIT RUN/STOP AND RESTORE
TO DISABLE"
100 REM ML DATA
110 DATA 169,0,133,254,173,47,19,208,12
120 DATA 173,42,3,141,46,19,173,43,3
130 DATA 141,47,19,120,169,34,141,42,3
140 DATA 169,19,141,43,3,88,96,198,254
150 DATA 208,7,238,32,208,169,0,133,254
160 DATA 76,0,0
170 REM MODIFICATION DATA
180 DATA 5,47,1,13,46,1,19,47,1,23,34,5
```

FUNCTION KEY CURSORS

C-64 owners have long begrudged C-128 owners their four independent cursor keys. On the 64 you must depress the SHIFT key to make the cursor go up or left. This arrangement is cumbersome to say the least.

The following routine solves the problem by causing the normally unused function keys (f1, etc.) to become four cursor keys. f1, f3, f5, and f7 act as CURSOR UP, CURSOR DOWN, CURSOR LEFT, and CURSOR RIGHT respectively. Some programs may have other uses for the function keys, though. In that case, you can disable the routine by holding down on the RUN STOP key and tapping the RESTORE key. Please also note that this routine will not work well with the Epyx *Fastload* cartridge and other such enhancer utilities. –Jim Partin
Cincinnati, OH

```
10 REM CURSOR/FUNCTION KEYS FOR C-64 BY
JIM PARTIN
20 FORT=49152TO49198:READDT:POKET,DT:NEX
TT
30 SYS49152:POKE49153,0:POKE49154,224:PO
KE49156,0:POKE49157,224
40 POKE49162,255:POKE49192,255:SYS49152
50 POKE60293,145:POKE60294,17:POKE60295,
157:POKE60292,29
60 POKE1,PEEK(1)AND253
70 END
80 DATA173,0,160,141,0,160,172,5,192,192
,191,240,23,238,1,192,238,4,192
90 DATA173,4,192,240,3,76,0,192,238,2,19
2,238,5,192,76,0,192,172,4,192,192
100 DATA255,240,3,76,13,192,96
```

LLIST.BAS

LLIST.BAS is a short BASIC 7.0 extension for the C-128 which adds an LLIST command. The LLIST command uses the same format as the standard LIST command, but sends the listing to the printer instead of to the screen. Perforations will be skipped on Star and compatible printers. You should find this easier than all those OPEN/CMD/LIST and CLOSE statements normally used to get your listing to the printer. –Bob Ossentjuk
Sierra Vista, AZ

```
3900 PRINT"[CLEAR]LOADING LLIST.BAS";
3915 FORX = 3960 TO 4095 :READA:CS=CS+A:
BANK 15 :POKEX,A:PRINT".";:NEXTX:PRINT
3930 IFCS <> 14008 THENPRINTCHR$(7)"DATA
ERROR!":STOP
3945 SYS3960
3960 DATA  169, 15, 141, 13, 3, 141, 15,
3, 141, 17, 3, 169, 147, 141, 12
3975 DATA  3, 169, 177, 141, 14, 3, 169,
196, 141, 16, 3, 96, 133, 2, 160
3990 DATA  171, 169, 15, 32, 226, 67, 14
4, 7, 105, 166, 162, 0, 24, 144, 3
4005 DATA  56, 165, 2, 76, 33, 67, 76, 7
6, 73, 83, 212, 0, 224, 0, 208
4020 DATA  12, 201, 40, 176, 8, 160, 171
, 169, 15, 132, 36, 133, 37, 76, 205
4035 DATA  81, 201, 40, 176, 6, 169, 15,
72, 169, 210, 72, 76, 169, 75, 169
4050 DATA  0, 141, 0, 255, 32, 189, 255,
```

Continued on page 90

AMIGA SECTION

DIGI-PAINT
NewTek
Amiga with 512K
Price: $59.95

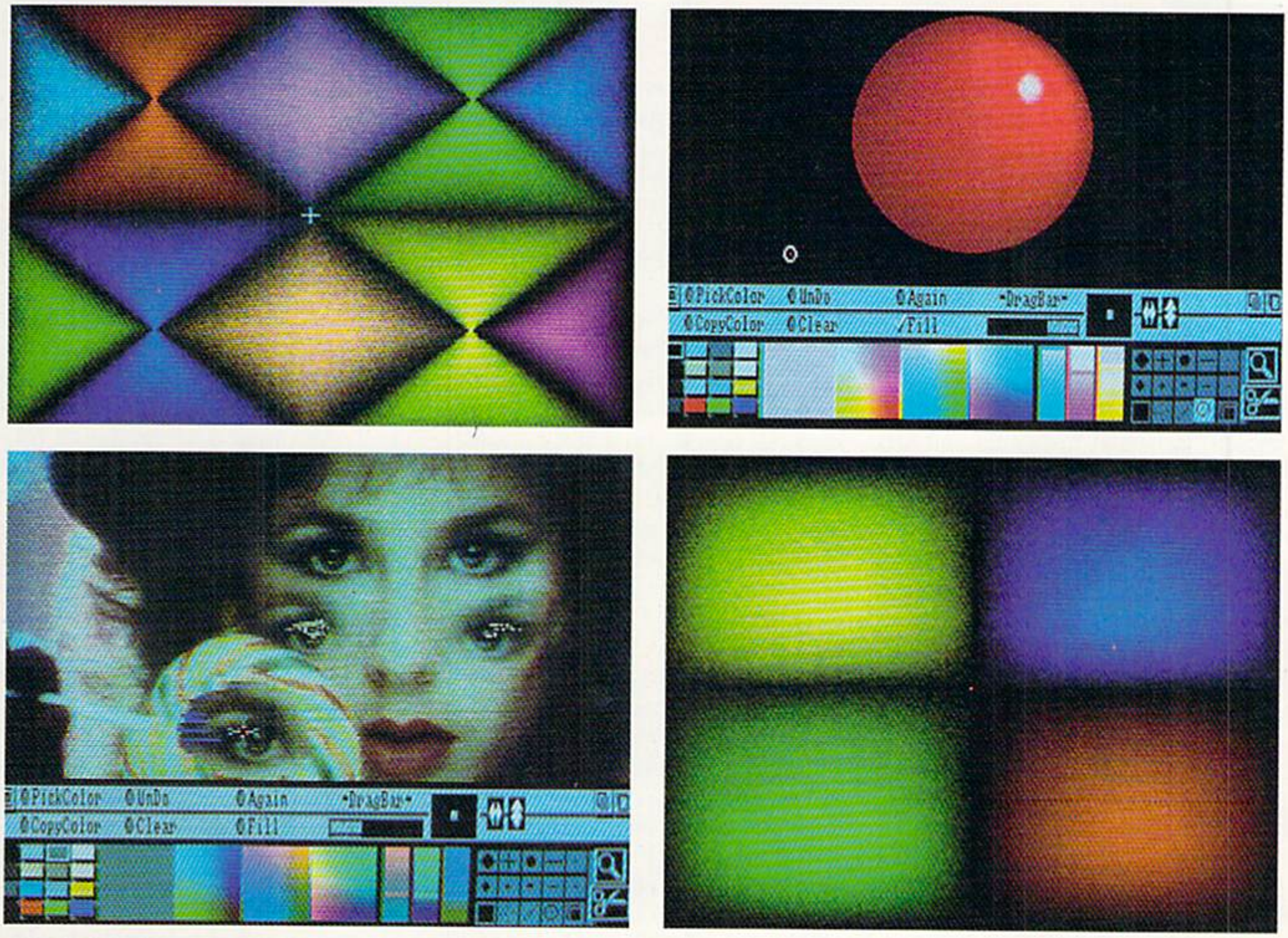
The first time we saw *Digi-Paint* in action was at the December '86 World of Commodore show in Toronto. At that time Tim Jennision, the proprietor of NewTek, was demonstrating an Alpha version of the program. (Alpha versions of programs come before Beta versions, Beta versions being what get sent out for testing before a program is released.) Although the program was far from completion, we were impressed with what we saw.

Digi-Paint is not just another general purpose bit map graphics drawing program for the Amiga. It is a drawing program which allows you to manipulate all of the Amiga's 4096 colors by working in the hold and modify mode (HAM). As such *Digi-Paint* does take some getting used to. It is not that *Digi-Paint* is difficult to use; on the contrary, we found its user interface to be well-designed. However, compared to conventional drawing programs which most Amigans have previously encountered, *Digi-Paint* can generate very unexpected results.

Fortunately, the *Digi-Paint* manual makes the transition as painless as possible. A three part tutorial leads the user through many of *Digi-Paint's* features. We found ourselves thoroughly hooked after going through the first part, which is nothing more than the colorization of a black and white digitized face.

Operations in *Digi-Paint* are selected from the menu which initially appears across the bottom of the screen. Although the menu can be positioned anywhere on the display, moving it up simply covers the working screen. The menu is best removed by clicking on its close gadget and restored by simply clicking on the right mouse button. Many operations in *Digi-Paint* will automatically remove the menu while they are taking place. In this case the menu is restored when the operation is complete.

If you've worked with other paint



Top left and bottom right: results of shaded fills with Digi-Paint. *Bottom left: the eyes have it as* Digi-Paint *lets you blend brushes into background. Top right: some well-rounded artwork.* *READER SERVICE NO. 163*

programs, you'll find many of the tools to be familiar. These include a collection of standard brushes, tools for geometric operations, a scissors tool for cutting custom brushes, and a magnify tool for detail work.

The color palette is by necessity somewhat elaborate. On the left is the current palette of 16 colors which can be placed anywhere on the image. The boxes to the right show the current color and all the possible derived colors. Refer to the description of HAM mode on the following page for a detailed discussion on how *Digi-Paint's* color palette works.

The PickColor tool on the main menu may serve to illustrate the unusual way color must be treated in HAM mode. Just activate the PickColor tool and move the pointer around the image while watching the color palette. The available colors dynamically change to follow the color which is under the pointer. In addition, the RGB values to the right of the palette are continuously updated.

The copy color tool is used to modify any of the 16 basic colors of the current palette. Changing one of these colors will instantaneously affect areas of the picture.

The Undo tool is used to cancel the most recent operation, including itself. The Again tool is used to repeat the last action, which is not as simple as it sounds. The repetition of many of *Digi-Paint's* operations produces cumulative results.

We found the RubThrough tool to be the most interesting of the lot. This tool brings the picture in the spare screen

HAMMING IT UP ON THE AMIGA

By Morton Kevelson







Shown are three views of* Digi-Paint's *color menu, used to illustrate the Amiga's 4096 color hold and modify display mode. At bottom left the base color is red, at top right it's green, and at bottom right we work with blue.

The Amiga's color graphics display has a working palette of 4096 colors of which, under the most common circumstances, up to 32 colors can be chosen for display at one time. It is possible, under less common circumstances, to display all 4096 colors at one time. The actual number of colors which may be used is dependent on the chosen horizontal resolution and the amount of memory allocated for the display.

The lowest resolution Amiga display mode has a screen which is 320 pixels wide by 200 pixels high and requires a minimum of 64,000 bits or 8000 bytes of the computer's memory. This collection of pixels or bits is referred to as a bit plane—that is, the bits are seen as a single layer organized as a grid with the above dimensions.

It may help to think of a bit plane as a layer of marbles on a colored surface. If some of the marbles are removed they become zeroes, while the remaining marbles are considered ones. Looking down at these marbles we can easily see two possible colors, that of a marble or the underlying surface. Thus a single bit plane can display only two colors at a time. A bit which is set to one may be considered as displaying the foreground color, while a value of zero displays the background color.

By some stretching of the imagination we can stack the marbles up to five layers deep. We now find that the colors we see depend upon the height of each stack. Of course this analogy is somewhat oversimplified, as the position of the marbles plays a part in the perceived color. We will not ask anyone to visualize the marbles floating above vacant positions as is required to complete the analogy. Our liability insurance does not allow for induced vertigo among our readers.

The Amiga's display chip has a total of 32 color registers, each of which contains 12 bits of color data. Of these 12 bits, four are assigned to each of the three primary colors, red, green, and blue. This allows for the mixing of 16 intensities of the primary colors or a total of 4096 possible shades. A single bit plane can utilize only two of the color registers. Additional color registers may be accessed by stacking bit planes. Thus a pair of bit planes can access four of the color registers and a stack of five bit planes can access any of the 32 color registers. A five bit plane image, of course, will require 40,000 bytes of memory.

The vertical resolution of the display may be doubled to 400 pixels by using interlace mode. Of course the memory requirements will double as well. The horizontal resolution may also be doubled; however, in this case the bit planes may be stacked only four layers deep and the number of possible colors is reduced to 16. A quick calculation shows that the most memory-intensive of these display modes would be for a 640 by 400 pixel screen with four bit planes. This requires a total of 128,000 bytes of display RAM.

The hold and modify (HAM) mode is a special display mode which allows all 4096 colors to appear in a single display. The HAM mode requires six bit planes and functions only in the lores display of 320 horizontal pixels with interface either on or off. Only 16 of the color registers are actually used by the HAM mode. Color register selection is thus done by only four of the bit planes. The first two bit planes per-

to the foreground in a variety of ways. The end result is dependent on the setting of the mode menu.

Additional commands and features are available from the menus, which are activated by the right mouse button. Many of these menus provide for mundane operations such as loading and saving of files, placing and retrieving images into and from the spare screen, loading and saving of brushes, and activating the built-in screen dump which follows the settings in Preferences. Incidentally, when *Digi-Paint* saves an image it creates an icon which is actually a miniature snapshot of the image (with limited colors, of course). When loading a file, *Digi-Paint* will automatically compress an oversize image to fit the current format; however, it will not expand a smaller image to fill the screen.

The Effect menu provides for doubling, halving, flipping, and switching the current image in just about every conceivable way. This menu will also soften the image by copying the screen in memory, shifting it one pixel, overlaying the original and the copy, and finally averaging the red, green, and blue values between the original and the shifted pixels.

The Mode menu is the most fascinating, as it is used to control how many of *Digi-Paint's* other operations will be performed. From this menu you choose between effects such as solid, shaded, or blended fills. Other possibilities are described by mathematical operators such as Add and Subtract, or by logical operators such as And and Or (how's that for a mouthful of double talk). The best way to find out about these effects is to try them out. The Shading feature deserves special mention. It comes equipped with controls for setting the amount of dithering and its direction, as well as the center of shading.

Although *Digi-Paint* may be used as a stand-alone graphics package, it will probably be used most frequently on existing images. It makes an excellent companion to *Digi-View*, NewTek's own video digitizer (March 1987).

NewTek, 115 W. Crane Street, Topeka, KS 66603 (phone: 800-843-8934).

—Morton Kevelson

form a special function which determines just how the color selected by the other four bit planes is displayed.

If the bit values of a pixel in the first two bit planes are both set to zero, the bit value of the last four bit planes selects the display color directly from the corresponding color register. If the first two bit planes contain a value of zero and one, the pixel takes its color from the previous pixel on the left. The difference is that the last four bit planes replace the red value of the color from that pixel. In a similar manner values of one and zero in the first two bit planes modify the green portion of the left hand pixel. Values of one and one will modify the blue value which was taken from the adjacent pixel.

The meaning of HAM should now be clear. HAM mode takes the color value of the left hand pixel and holds the value of two of the pixel's primary colors while it proceeds to modify the value of the third primary color. This obviously places a limitation on how fast the colors of adjacent pixels can change. In order to change all three of the primary colors, we have to do it in three steps. Each step moves us one pixel to the right. An abrupt change in color may be obtained by simply selecting a different one of the 16 color registers. Of course this drastically limits our choice of colors.

With the help of *Digi-Paint* we will illustrate the workings of HAM. The accompanying photographs are taken directly from *Digi-Paint's* color menu. Looking at the first photograph, the array of 16 small blocks on the left is the current palette. The large solid color block immediately to the right of the palette shows the selected color. In this case it is a solid red with RGS values of 15, 0, 0.

Continuing to the right, the first multicolored block, marked with a red dot, shows all possible shades of color with the red value set to 15. In this block the top row of pixels holds the red and blue values to 15 while the green value starts at 15 and goes to 0 in 16 steps. The leftmost column holds the red and green values constant while the blue value varies from 15 at the top to 0 at the bottom.

The second multicolor block shows the 256 possible colors with the green value held to 0. In this block the blue value varies from 15 on the left to 0 on the right while the red value starts with 15 at the top to 0 at the bottom. The third multicolor block holds the blue value to 0. In this case red runs horizontally from 15 to 0, left to right, while blue starts from 15 at the top and goes to 0 at the bottom. Each of these three multicolored squares contains a total of 256 unique colors.

The second photograph repeats the process using green as the selected color. In this photograph, the first multicolor block holds red constant at 0 with green varying horizontally and blue varying vertically. The second multicolor block holds green constant at 15 with blue varying horizontally and red varying vertically. The third multicolor block holds blue constant at 0 with red varying horizontally and green varying vertically.

The third photograph is based on blue as the selected color. We will leave the determination of the color variations up to you. It should be apparent that each square in each group of three contains one point which is the selected color, two squares contain a black point, and one square contains a white point. Our set of three photographs contains a total of 1532 unique colors.

ROADWAR 2000
Strategic Simulations
Amiga (512K)
Disk; $39.95

The 21st century is not the best time to be an American. The United States has virtually collapsed as a result of an epidemic followed by civic disorder and foreign invasion.

Roving bands struggle for control of the ruined cities and scarred countryside. Although some clashes are melees between mobs on foot, the fiercest fights occur between squads of armed and armored vehicles. These "roadwars" give this involving strategy-adventure its name and provide most of the mental challenge and excitement.

The main display is a multiscreen map of the United States. When the player moves off one edge, the next section scrolls into view.

Urban enclaves, terrain, and the crucial highway network are clearly marked. Regions carefully suffering active disease outbreaks are flagged with the skull (poison) symbol for the benefit of gangs which have not accumulated enough medical supplies to with-

stand the onslaught of disease.

The player moves his gang, symbolized by an onscreen icon, either overland or along the roads. Each daily turn, the gang may explore the territory, fight a battle, hunt for vehicles or materials, parlay with another group of people, or add a specialist such as a Doctor or Politician to the entourage.

There are many types of potential enemies. Armed rabble has little more than force of numbers, but a renegade National Guard detachment or a division of invading troops is a tough nut for all but the biggest gangs to crack.

There are three types of vehicular combat. The game prompts the computerist to select one of the alternatives when a battle is imminent.

Abstract combat is fast, bloody, and simple. Most novice players like this method, which merely reports losses for each side on a turn by turn basis.

The only way to expand the gang's roster of vehicles, however, is to win a battle fought using one of the two more detailed combat systems.

Both methods utilize a second display screen which shows a close-up view of the disputed territory. Cars may be displayed as symbols or facing icons, depending on the preference of the player.

Detailed Combat is the ultimate. The player assigns gang members to crew each vehicle, positions the cars and trucks on the road in the most advantageous positions prior to the actual battle, and follows the prompts of onscreen menus to order vehicles to move and attack.

The Quick Combat system is similar, except that complications like boarding for hand-to-hand combat and capturing enemy vehicles are eliminated in the interests of brevity. Another handy aid is the automatic deployment option, available during either Tactical or Quick Combat, which instantly doles out gang members to each of the outfit's motorized mayhem machines.

Each road combat situation is practically a game in itself, and many users will be content simply to drive around the country and slug it out with an inexhaustible parade of foes.

Roadwar 2000 is more than a battle program. Proficient players start a campaign with a handful of flunkies and must pick up additional men and material as the game progresses. The goal is to find the scientists and bring them together in time to save what remains of America while wrestling with other gangs, climate and terrain hazards, and the shortage of key supplies.

More imperialistic players can also try a slightly different type of campaign scenario. Since *Roadwar 2000* records the name of every city conquered by the player's gang, another possible goal is the conquest of the real estate formerly occupied by the U.S.A. This doesn't cure the disease, of course, but someone who achieves this herculean task can rightly claim to have restored civilian authority to the chaotic land.

The graphics are slightly better in the Amiga edition of *Roadwar 2000* than in the original, published for the Apple II by SSI in late 1986. Yet like most SSI products, the visuals are definitely secondary to the play-mechanics of the game. The Amiga graphics are serviceable rather than exciting.

Roadwar 2000 is a game which becomes more enjoyable the more often it is played. It promises many, many hours of stimulating fun.

Strategic Simulations, 1046 N. Rengstorff Ave., Mountain View, CA 94043 (phone: 415-964-1353). *–Arnie Katz*

TEST DRIVE
Accolade
Amiga with 512K
Disk; $44.95

So many automobile games have appeared lately that squeamish computerists may have to pop a car sickness pill before they turn on the machine. In *Test Drive*, the creation of Distinctive Software, the player slips behind the wheel of one of five race cars and challenges a twisting mountain course called "The Rock."

The introductory screens radiate class. First comes the insistent techno-rock beat of the theme. Then the company's logo appears as a voice intones, "Accolade Presents." A sleek sports car fills the screen. The opaque window rolls down, and the driver favors the computerist with a comradely look. The driver guns the motor and drives off the left edge of the display.

Talk about setting a mood! If the rest of *Test Drive* upheld this high level of technical virtuosity and dramatic staging, it might be the greatest computer game ever designed.

It doesn't, and it isn't. The visible steering wheel and pop-up gearshift window enhance the realism of the simulation, but other aspects are surprisingly weak. The mountain scenery is bland, the crashes are perfunctory, and the course if rather short.

The five vehicles are among the royalty of competitive auto racing: Porsche 911 Turbo, Ferrari Testarossa, Lotus Turbo Esprit, Lamborghini Countach, and Chevy Corvette. Each is a unique machine, and *Test Drive* conveys a lot of the special feeling of controlling a car capable of speeds of 150 mph or more. The Porsche features exceptionally responsive handling, and the Lamborghini can duplicate its actual 175 mph top speed.

The driver reviews the cars prior to the start of the race. Moving the joystick forward and back cycles among the five display screens. Each shows a beautiful side drawing of the car and a detailed performance report and acceleration graph.

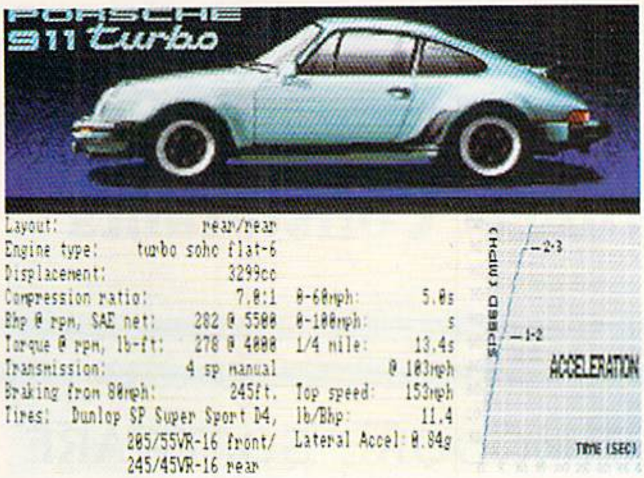
When the player presses the action button to confirm a choice, the driver of the car rolls down the window, cocks his head in salute, guns the motor, and rolls off the screen.

Unlike many older racing simulations, *Test Drive* puts the user right in the driver's seat instead of showing the car from an imaginary point about 10 yards behind it. Obviously, this first-person viewpoint makes *Test Drive* a much more involving simulation.

Although the onscreen control panel always presents essentially the same information, there is a separate dashboard configuration for each car. It is always hard to equate joystick movement with the turning of a wheel, but seeing it move to the left and right helps bridge the gap.

The rear view mirror, located in the upper right corner of the screen, lets the driver look behind as well as ahead. The animation is perfectly matched to the animation in the front windshield. Watching cars and trucks pass in the opposite direction is a visual treat.

Shifting technique is more important in *Test Drive* than in any previous auto program. Precise shifts keep the vehicles roaring up the mountain pike, past potholes, and around sharp turns, while



Left: reviewing your car before your Test Drive. *Bottom left: each car has its own dashboard.* *READER SERVICE NO. 165*





Bottom right: part of Roadwar 2000's *map.* *READER SERVICE NO. 166*

sloppy work with the gear shift can over-rev the engine.

The player has five tries to complete the entire course. After a crash, signified by a cracked windshield, pressing the action button of the joystick allows the car to resume its journey.

While high speed is a necessary and desirable part of *Test Drive*, the designers also added the complication of the highway patrol. If a radar trap clocks the car going faster than the limit posted on the roadside sign, odds are good that a trooper will soon pull the player over for speeding. It is possible, though unlikely, for the player to outrun a police car.

The only defense is the radar detector installed in each car. When a red light starts blinking, a radar trap is near. When all the lights flash, the radar is actually measuring the car's speed. Wise drivers never lose track of either the legal speed limit or the status of those warning lights.

Test Drive, despite its irritating flaws, is an outstanding racing simulation for the Amiga. Driving game fans should waste no time claiming their piece of "The Rock."

Accolade, 20813 Stevens Creek Blvd., Cupertino, CA 95014 (phone: 408-446-5757). *—Arnie Katz*

CPS-500 POWER SUPPLY
Phoenix Electronics, Inc.
Amiga 500
Price: $99.95

As of this writing the vast majority of Amiga 500's are still under Commodore's warranty. It thus strikes us as somewhat unusual that Phoenix is already offering a replacement power supply for the Amiga 500. On the other hand, we have seen a report that one of the first batches of Amiga 500 power supplies was defective and has been replaced by Commodore. Perhaps Phoenix knows something we don't.

In fact the Amiga 500 power supply has been designed to closely match the current requirements of a basic Amiga 500 system. By this we mean the computer, its 512 kilobyte memory expansion, and one external disk drive. The Amiga 500 power supply has virtually no reserve margin for any additional peripherals beyond the basic system. The CPS-500 provides sufficient additional capacity to power at least a couple of megabytes of external ROM.

The following table compares the current capabilities of the CPS-500 with the Amiga 500's original power supply. We have also included the current ratings for the power supply provided with the Amiga 1000. The latter values are for information only, as the power requirements of the Amiga 1000 are not the same as for the Amiga 500. Note that all voltages are DC. Based on the specified values, the output power capability of the CPS-500 is 50 watts.

POWER SUPPLY RATINGS IN AMPERES

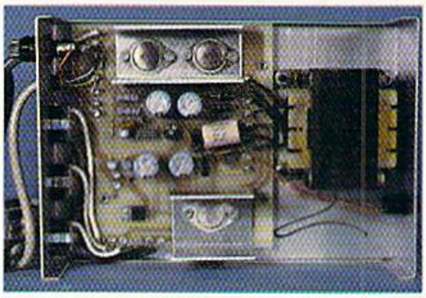
	+5V	+12V	−12V	−5V
A-500	4.3	1.0	0.1	NA
CPS-500	6.0	1.25	0.5	NA
A-1000	8.0	1.0	NA	0.25

As with all the Phoenix power supplies, the CPS-500 comes in an aluminum vented enclosure. The front panel includes an ON/OFF switch, but it lacks a power indicator light. The back panel is fitted with a user-replaceable fuse and three grounded convenience outlets rated at 100 watts each. The ON/OFF switch and the fuse provide control and protection of both the power supply and the convenience outlets. Surge protection is provided on the incoming power line.

The internal construction of the CPS-500 is similar to that used for the C-64 and C-128 versions of the Phoenix power supplies. We suggest you refer to the reviews of the CPS-10 and CPS-128 in this issue, as well as the feature on power supplies, for additional details on power supply application and design. As for the CPS-128, the voltage of the five volt supply in the CPS-500 is internally adjustable. The plus and minus 12 volt supplies are derived from fixed voltage integrated circuit regulators.

The CPS-100 is about the size of the 1010 external disk drive. It should be possible to stack these devices if spread about 1" for ventilation.

Phoenix Electronics, Inc., P.O. Box 156, Clay Center, KS 67432 (phone: 913-632-2150). *—Morton Kevelson*



The CPS-500 for the Amiga 500.
READER SERVICE NO. 169

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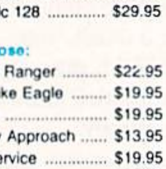
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POWER TO THE COMPUTERS *Continued from page 30*

DIAGNOSING POWER SUPPLY PROBLEMS

Historically, the C-64 power supply has been problematic. We have experienced numerous difficulties of our own with this device and have received substantial feedback on the topic from other users. The C-128's power supply seems to be made of sterner stuff. Our own units have performed flawlessly from Day 1 and we have not heard any complaints from outside sources. Feel free to correct us if you have other information.

The most persistent problem with the C-64 power supply has been a gradual deterioration of the external 5 volt regulated power supply. The regulator circuitry used in this supply has the ability to detect abnormal operating conditions such as high temperatures or short circuits. When an abnormal condition is detected the regulator acts to shut down the supply, preventing or limiting damage.

We have found that as the C-64's power supply ages, the sensitivity to abnormal conditions seems to increase. What was previously a normal operating condition seems to become a cause for an emergency shutdown. If the C-64 is being used with a video monitor, then a shutdown of the external power supply can be easily recognized. The computer will freeze up and random characters may appear on the display. The display continues to operate, as the power for the VIC chip and its associated circuitry is derived from the external 9 volt AC supply. If a TV is used as a display device, the picture will also disappear, as the RF modulator runs off the external 5V supply.



We have experienced the degradation phenomenon with no fewer than four C-64 power supplies. The scenario goes like this. Initially everything works fine, including a printer interface powered from the cassette port. After a while we find that the power supply starts to shut down after operating for an hour or two. Prolonged operation may be restored by removing the additional burden of the printer interface. This is only a momentary reprieve, as after a brief time the computer alone triggers the power supply's cutoff circuit. From this point on we experience decreasing operating intervals until the 5V supply fails entirely.

The scenarios we have described are not the only causes of power supply failure. Other possibilities include the destruction of the supply by an incoming power line voltage surge. We also expect that a fair number of units bite the dust when the cable or connector fails because of excessive mechanical flexing.

Keep in mind that the C-64's and C-128's power supplies do not have an on/off switch. Once they are plugged in they remain continuously energized. For those setups which employ an external power switch to turn off the power supply, we offer the following recommendation. Always turn on the computer, using its own power switch, after energizing the power supply. Conversely, always turn off the computer, using its own power switch, before deenergizing the power supply. This procedure should allow the power supply to stabilize and hence it will minimize the possibility of power transients entering the system. Though we feel that this procedure will prolong the life of the computer, we do not know of any cases in which not following it will shorten the machine's life. ☐

THE EXTRACTOR

For the C-64

By R. Harold Droid

The Extractor lets you review the contents of a sequential file and select lines or batches of lines for extraction. Then it writes the shortened file back to disk. It's great for removing superfluous material from terminal program capture buffer saves and doc files. If you keep a record of your online sessions on disk or printout, you can clean them first of prompts, menus, and other repetitiveness. *The Extractor* also has options for automatic removal of extra spaces and carriage returns. If you use a word processor's "read a sequential file" option to generate nice looking printouts with paging and margins, these features can save you a *lot* of editing time.

The Extractor lets you scroll forward or backward through a file, selecting and deselecting parts, reviewing and revising your work as you go. The ability to scan in both directions, plus its "page forward" and "page backward" commands, make it an ideal sequential file *reader,* too.

The Extractor is machine language that loads and runs like BASIC. With BASIC ROM banked out of the system and a program size of only eight blocks, *The Extractor* leaves a whopping 192 blocks for storage. The maximum file size it can actually accommodate depends on how many blank lines and partially blank lines the file contains. The big text buffer makes *The Extractor* especially useful for splitting extra-long sequential files into smaller portions that won't overflow your word processor.

When you run *The Extractor,* a help screen pops up that summarizes the available commands. Any keypress takes you to the workscreen. Initially the display area is blank, indicating no file in memory. To get started, press R to read a file. Press ? to review the commands.

Files are displayed in upper/lower case, with carriage returns indicated by a checkmark. Use the cursor up/down keys to move text. The commands are detailed in the sidebar.

The stripping modes are available from a menu which appears after an R or A command. They "pre-edit" the file as it loads, automatically performing chores which you would otherwise have to do by hand. The choices are:

1. No stripping, just read the file "as is."

2. Strip extra returns. Blank lines enhance readability but waste memory and paper. As it loads the file, *The Extractor* will look for consecutive carriage returns and ignore any that exceed a certain number. You specify this limit at a second prompt. Acceptable values are 1-9. A non-space or non-return charater starts the count over again.

3. Strip line returns. Lines of 39 or 79 characters, each terminated by a carriage return, are one of the commonest sequential file formats and the most irritating for word processing. It's impossible to change the margins on such a document because the returns "preset" the line length. This option removes every single carriage return (every carriage return that's not followed by another carriage return). You

M—This is a toggle, selecting whether you're marking or unmarking text. Marked text appears in reverse video. When marking/unmarking is turned on (using the O key), text is selected or deselected as you move the cursor. This allows you to mark or unmark as you read. Note that you can't cursor right or left to mark individual characters; *The Extractor* extracts lines. A message on the bottom line of the screen reminds you whether you're currently "marking" or "unmarking."

O—Also a toggle, it disables both "marking" and "unmarking"; the accompanying status line message is "marking disabled." It lets you move the cursor without altering text.

@—This marks or unmarks *all* the text, even when cursor marking/unmarking has been disabled with "O".

X—Exchange. Marks currently unmarked text; unmarks currently marked text. Useful when it's quicker to mark sections you want to *remove;* press this key as the last step before writing back to disk.

T—Mark/unmark all text from the top of the file to the cursor.

E—Mark/unmark all text from the cursor to the end.

F—Jump forward one screen. No marking or unmarking, just a quick way to scan the file.

B—Jump back one screen.

HOME—Move cursor to the beginning of the file.

R—Read a sequential file into memory, erasing any previous file.

A—Append a sequential file. Read a sequential file and add it to the end of any file already in memory. On either a read or an append, you'll see a "text area full" message if your file is too big to fit. You do, however, have the opportunity to edit the partial file.

W—Write marked (reverse-video) text back to disk. You'll be prompted for a new filename under which to save.

D—Delete from cursor to end of text. This is handy if you accidentally loaded the wrong file or if, after reading the file, you decide you'd like to reread it using one of the special stripping modes.

may have to reparagraph by hand when you load the stripped file into a word processor, but it's better than manually removing several hundred returns.

4. Strip extra spaces. This corrects spacing problems, which appear most often in documents that have been right-justified: in such a document, extra spaces are added between words to make a smooth right margin. Choice #4 removes them, allowing one space between words and two after periods, exclamation points, and question marks.

When reading a file into memory with the stripping modes, remember that computers recognize characters but not human intent. The simple methods used here cannot possibly cover all nuances of punctuation and format. Stripping spaces can, for example, turn a perfectly formatted table into unreadable mush. You may wish to extract and save different parts of a file, reread them again using different stripping modes, and recombine them with the A (append) command. In some cases it may be better to edit the whole thing manually. In most cases, however, reading-with-stripping can save you from 50-90% of the busy work involved in preparing a sequential file for handling by a word processor.

Customizing the program is easy. If you don't like the choice of screen colors (white characters on a black background is pretty basic) do the following. Load the program, POKE a new color code (0-15) into one or more of the following registers, then resave under a new name.

POKE 4086 to change the text color
POKE 4087 to change the background color
POKE 4088 to change the border color
POKE 4089 to change the color of the status message

I recommend using matching background and border colors. Having the border color to compare against helps you keep track of which text is marked and which is unmarked.

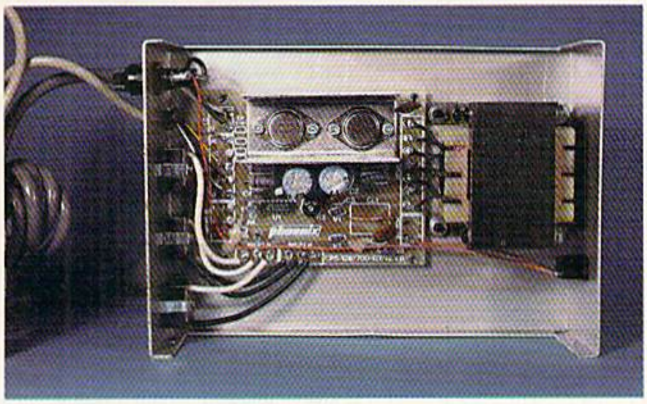
It's possible to lower the top of the text buffer and protect upper memory from being clobbered by a long file. This may be desirable if, for instance, you want a utility program at $C000 to stay resident while *The Extractor* is running. The top limit defaults to $D000; to lower it, POKE 4090 with the low byte of the new address and POKE 4091 with the high byte.

Use *Flankspeed* (see page 75) to type in *The Extractor.* Before you LOAD *Flankspeed,* you'll have to set some pointers. This will prevent *Flankspeed* from being overwritten by *The Extractor.* Enter the following line, then LOAD *Flankspeed:*

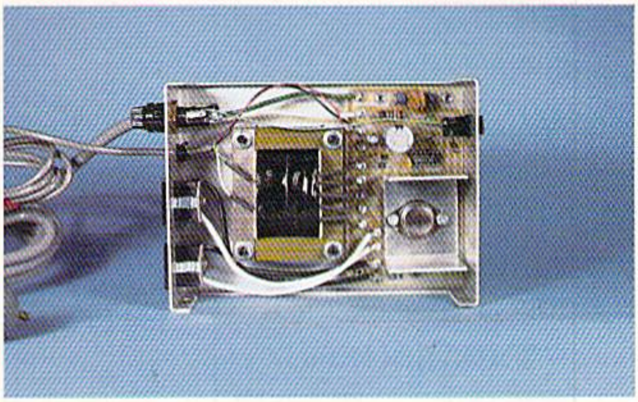
```
POKE44,64: POKE 16384,0:NEW (hit RETURN)
```

Whether you're pulling the sediment out of a capture buffer, cutting blank lines to shorten a file, or reformatting for word processing purposes, *The Extractor* is a time- and space-saving tool. Used either in conjunction with your favorite word processor or on its own, it'll keep your disks clean, your printouts pretty, and your fingers flexible. ☐

SEE PROGRAM LISTING ON PAGE 88



Phoenix Electronics' CPS-128 replacement power supply for the C-128. READER SERVICE NO. 167



The CPS-30 is more than just a replacement for the C-64's power supply. READER SERVICE NO. 168

CPS-10, CPS-128 POWER SUPPLIES
Phoenix Electronics, Inc.
C-64 and C-128
Price: CPS-10 $59.95
CPS-128 $79.95

Based on our own experience, we feel that sooner or later many C-64 users will be in the market for a replacement power supply. On the other hand, the C-128 power supply seems to be of a more durable design. In conjunction with our feature on Commodore power supplies we decided to take a look at one alternate source, other than our own ingenuity, for C-64 and C-128 power supplies.

The Phoenix power supply line currently consists of four models: two for the C-64, one for the C-128, and one for the Amiga 500. For this review we took a look at the CPS-10 for the C-64 and the CPS-128 for the C-128. All the Phoenix power supplies are direct replacements for the originals that come with the computers. As can be seen from the accompanying table, their output current ratings in amperes are equal to or greater than those of the originals. The lines for the C-64 and the C-128 are the ratings for the Commodore originals. Also included are ratings for the power supply provided with the 1764 RAM expansion module. Note that the output for the Phoenix supplies are rated at 10V AC as compared to 9V AC for the originals.

The units we examined all have a similar construction which consists of a ventilated aluminum enclosure with an on/off switch on the front. Line power is obtained via a heavy duty three prong grounded cord. The CPS-10 is also equipped with a pair of grounded utility receptacles on the back, while the CPS-128 is fitted with three utility receptacles. A user-replaceable line fuse is right next to the receptacles. The fuse provides protection for the power supply and anything which may be plugged into it. The utility receptacles, which are rated at 100 watts each, are also controlled by the on/off switch. The chassis rests on a set of rubber feet.

POWER SUPPLY RATINGS IN AMPERES

	5V DC	10V AC
C-64	1.5	1.0
C-1764	2.5	1.0
CPS-10	3.0	1.0
CPS-30	2.0	1.0
C-128	4.3	1.0
CPS-128	6.0	2.0

We found the boxes to be sealed with aluminum "pop" rivets which can be easily drilled out for servicing. After doing just that we found the parts layout inside the box to be neat and uncrowded. The dominating feature is the AC power transformer alongside the glass-epoxy circuit board which carries the rest of the components.

The Phoenix power supplies are of standard analog design. The circuit is built around an MC1723 integrated circuit voltage regulator. This particular integrated circuit is a tried and proven device which has been around for several years. It is a general purpose, low power voltage regulator which can be used for a variety of power supply applications. The MC1723 includes automatic current limiting and automatic shutdown for short circuit and high temperature conditions.

In the CPS-10 the 5 volt supply voltage was set by a pair of fixed resistors. In the CPS-128 the 5 volt supply voltage was set by an adjustable resistor. Since the MC1723 is a low power device, the high current rating is obtained by utilizing a power transistor as a shunt element. In this case the CPS-30 uses a single 2N3055 power transistor while the CPS-128 uses two transistors in parallel. Heat dissipation for the power transistors is provided by sheet aluminum heat sinks. All the components are soldered in place.

Both power supplies are equipped with minimal power line surge protection by a trio of metal oxide varistors (MOV). According to Phoenix the test specification for these MOVs is 8 pulses of 20 microseconds with a peak current of 500 amperes. An energy absorption rating was not provided; however, by comparison the Radio Shack units mentioned in the accompanying power supply feature were tested at a peak current of 6500 amperes. The Radio Shack MOV has an energy absorption capacity of 70 Joules.

Overall, if the need arises, the Phoenix power supplies should be reliable

replacements for the original Commodore units. Both the CPS-30 and the CPS-128 provide enough spare capacity to power the computers and some peripherals.

Phoenix Electronics, Inc., P.O. Box 156, Clay Center, KS 67432 (phone: 913-632-2150). *—Morton Kevelson*

MOVING PICTURES
C.D.A. Inc.
Commodore 64
Price: $29.95

AHA!, we have often exclaimed as we succeeded in clarifying another obscure microcomputing concept. Perhaps this was just what Nick Sullivan and Chris Zamarra had in mind when they chose this acronym as the name for their software company. For the terminally curious, AHA! signifies Acme Heuristic Applications! For all others we mention that Misters Sullivan and Zamarra are both editors of *Transactor* Magazine and longtime gurus in their own right. In any event, with regard to *Moving Pictures* we say "AHA!, this looks like a useful package."

Moving Pictures functions as an extension to the dialect of the BASIC language provided with the C-64. Its added commands allow for the manipulation of high resolution bit mapped images into simple animated displays. The table summarizes the *Moving Pictures* commands.

The production of an animation with *Moving Pictures* is a two step process. The first step is to create the sequence of images which will become the movie upon being presented in their proper sequence. The images required by *Moving Pictures* are nothing more than a sequence of 8000 byte, high resolution bit maps which generate a 320 by 200 pixel display on the C-64. The method used to create the images is up to the user. The best approach is to use a commercial drawing package such as *DOODLE!* or *Flexidraw*, both of which are supported by *Moving Pictures*. We found that the files produced by *The OCP Art Studio* could be used as well after they have been properly renamed.

When creating the images for the movie, keep in mind that the Moving Pictures Compiler (MPC) will combine the images into a single file. This entire file will have to be loaded into the computer when it is shown. To keep the length of the movie file as short as possible, MPC saves only the difference between successive frames. Of course the requirement for smooth animations helps to insure that differences between successive frames will not be large. We found that successive frames with large variations tended to slow down *Moving Pictures* and BASIC. If the differences were large enough, the maximum frame rates could not be attained.

The source file names for MPC consist of a common name for all the original files followed by a numerical suffix. To meet this requirement we had to rename each of the *OCP Art Studio* files to eliminate their "PIC" suffix.

Moving Pictures Commands

AHA—Displays copyright message
CLEAR—Clears the hi-res screen
COLOR f,b—Sets the foreground and background colors
COLOUR f,b—Same as COLOR
CUT [n]—Stops movie at frame n
CYCLE n—Continuous display of movie n
DEFAULT—Resets parameters to startup values
ELSE—As in IF...THEN...ELSE
EXIT—Disconnects *Moving Pictures*
HELP—Displays list of commands
HOLD [n]—Freezes BASIC till frame n is displayed
INFO (n)—Function which returns data about current status of *Moving Pictures* such as current speed and number of movies in memory
KILL—Immediate stop of movie
OFFSET v,[h]—Shifts the bit map display vertically or horizontally
PAUSE—Pauses movie at the current frame
REMOVE—Clears a movie from memory
RESUME—Resumes a PAUSEd movie
SHOW m,n—Displays movie m for n times
SLIDE [n]—Smooth transition between split screen positions
SPEED n—Displays movie at 1-6, 10, 12, 15, 20, 30, or 60 frames per second
SPLICE var$(n1),n2—Loads movies specified by range of string variables into memory
SPLIT [n]—Splits the screen between graphics and text at line n

The use of sequentially numbered file names allows MPC to automatically compile the frames in their proper order. Although a single 1541 disk has a capacity of only twenty 8000 byte bit map files, MPC can link movies over several disks. Thus it is possible to link large numbers of images as long as successive frames differ by small amounts.

To display compiled movies, simply load up the *Moving Pictures* operating system and execute the appropriate commands in either direct mode or under program control. The *Moving Pictures* code resides in the $C000 block, while movies are loaded into the top of BASIC's RAM space. The SPLICE command is used to load one or more movies into memory. The disk drive's status is reported as each movie loads. Since *Moving Pictures* is interrupt driven, a BASIC program can be executed or run while a movie is running.

Moving Pictures manipulates only the 8000 byte bit map without affecting the 1000 byte color memory associated with the hi-res display. If the frames of the movie are properly designed, it is possible to load the color data into RAM for use with the movie. A utility program is supplied on the distribution disk to extract the 1000 byte color data file from a *DOODLE!* image. This file may then be loaded in for use as the color for the movie. This color screen will be wiped out if *Moving Pictures'* own COLOR command is invoked.

The default display consists of twenty lines of bit map and five lines of text, but this can be changed. Besides the flipping of frames, it is possible to change the display in two other ways. The SPLIT command lets you choose the number of screen lines which will be devoted to text versus the amount of space within the bit map. The OFFSET command allows you to shift the bit map itself by an integral number of character spaces. In this way portions of the bit map, which may be obscured by the split screen, can be selectively displayed.

If you are reasonably familiar with BASIC programming, *Moving Pictures* will be easy to learn. To start with, try out the various demos included with the distribution disk. Once you have been suitably impressed, follow the instructions for SPLICEing in some of the demo movies. Then start up a movie and proceed to experiment with the various commands. The split screen feature makes it easy to experiment interactively using BASIC's immediate mode. Once you have gotten a feel for *Moving Pictures* commands, you are ready to start writing some BASIC programs with them.

The *Moving Pictures* distribution disk contains two additional utilities. An older version of the *Super DOS* fast loader from Prism Software is provided to greatly speed up disk operations. This fast loader is known to be temperamental with regard to the disk drives it will work with. It is particularly fussy about alignment and drive speed. If *Super DOS* works with your 1541, then so much the better. Otherwise just ignore it.

If you boot *Moving Pictures* from the provided menu program, you will also have access to the included help files. These help files contain nearly the entire manual on disk. In fact this was the only documentation provided with the first release of *Moving Pictures.* The help routines are designed to work with any properly formatted sequential text files. You can create your own help system for other programs by transferring the appropriate files and setting up your own text.

Overall, *Moving Pictures* is an easy to use extension to BASIC which allows you to compile a series of 8K bit map screens into an animated sequence. Although its use of color is somewhat limited, the available features represent a good tradeoff between operating speed and the available hardware resources.

C.D.A. Inc., P.O. Box 1052, Yreka, CA 96097-1052 (phone: 916-842-3431).

—Morton Kevelson

OUTRAGEOUS PAGES
Electronic Arts
Commodore 64
Disk; $49.95

Yet another *Print Shop* knockoff? While there *have* been a lot of programs that would fit that description, this one really is different. It's an icon-driven design board for the layout of almost any type of sign, newsletter, or bulletin, simple enough to allow even a novice to create professional looking work. It's probably as close as you can

get to genuine desktop publishing for the Commodore 64.

Outrageous Pages is the fifth-generation child of icon-oriented software like *GEOS,* programs that allow the user to operate the application by pointing at different pictures on the screen with an arrow and pushing the fire button. I expected the program to be user-friendly, but it performed beyond my highest expectations.

If *GEOS* is user friendly, then *Outrageous Pages* warrants the description "subliminal." I had this program up and operating in 10 minutes without barely a glance at the manual. The commands are so visually oriented that control of this program approaches Zen.

A joystick- or mouse-controlled pointer is used to select different icons from the right side of the screen. What I like about these symbols is that they really look like the objects they're supposed to represent. The disk drive, scissors, text icon, and their brothers are well-chosen for their obvious meanings, contrary to the hieroglyphs in *GEOS* and similar systems. With the exception of the text processor, the control system is almost completely visual; a real plus for me, as I find it annoying to keep switching from keyboard to mouse while running a program.

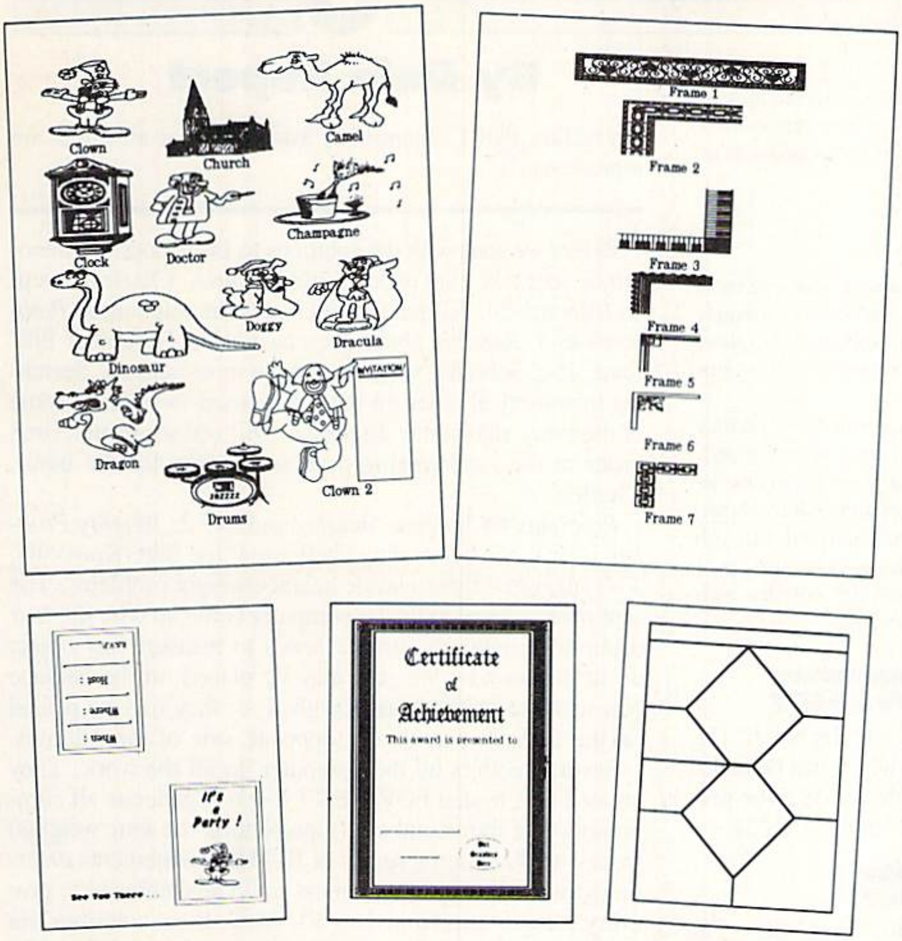
Incredibly enough, the icon pointer is only a pointer when it is not on the design screen, which occupies the lower ¾ of the screen display. When the pointer is moved onto the design grid, it changes into a set of intersecting horizontal and vertical lines that are used for formatting your display. Classy touches like this demonstrate genuine care on the part of the programming team.

The actual text editor for documents brought tears to my eyes. It featured wordwrap, centering, and justification, even margin controls for both left and right edge of the text fields. Most word processors don't even have these options. The default font was beautiful and crisply drawn, but it was only one of many included on a separate disk.

For the beginner who is a little nervous about designing his own layouts, there is a disk of predesigned templates he can load in and format to his own needs. This templates disk contains patterns for newsletters, bulletins, calendars, and other common requirements for schools and churches, etc.

As if all this were not enough, you have an entire disk full of patterns and artwork you can lay down beside your creations, enough to suit almost anyone's purposes. In the event you cannot find the type of design you need, a converter for *Print Shop* files (practically an industry standard) is included on the disk. This opens up the door to an almost unlimited universe of designs which can be incorporated into *Outrageous Pages*. People who feel themselves lacking in artistic talent will be glad to know that they can create excellent professional results simply by using good judgment and patience in laying down the text and artwork.

The printer support is one of the few weak points about the entire package. I felt that the disk did not include quite enough printer drivers, which are an absolute must for a program like this. As long as you have an MPS-801 compatible, you won't have a problem, but users with unusual printer configurations may encounter a little frustration. Epson and Star, the most common third



Outrageous Pages ***supplies clip art, borders, and typefaces for creating invitations, certificates, and more.*** ***READER SERVICE NO. 189***

party printers, are also well-supported. With my Commodore-compatible SR-2000 from Sears, I was able to use the MPS-801 driver without experiencing any problems.

Outrageous Pages comes with my highest recommendation. It is a stand-up winner in the *Print Shop* mob, far surpassing its mentor. You'll find it a very satisfying addition to your software library.

Electronic Arts, 1820 Gateway Drive, San Mateo, CA 94404 (phone: 415-571-7171). *—Cleveland M. Blakemore*

PROGRAMS WANTED!

We're always in search of the best game, utility, and productivity programs available. If you've written a program which fits that description, send it on disk, accompanied by printed documentation, a program printout, and a stamped, self-addressed envelope to:

Ahoy! Program Submissions Dept.
Ion International Inc.
45 West 34th Street—Suite 500
New York, NY 10001.

Payment is made on acceptance, at highly competitive rates.

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The publisher cannot assume responsibility for errors in the above listing.

COMMODARES

By Dale Rupert

Each month, we'll present several challenges designed to stimulate your synapses and toggle the bits in your cerebral random access memory. We invite you to send your solutions to:

Commodares, c/o *Ahoy!*
P.O. Box 723
Bethel, CT 06801

We will print and discuss the cleverest, simplest, shortest, most interesting and/or most unusual solutions. Be sure to identify the *name* and *number* of the problems you are solving. Also show sample runs if possible. Be sure to tell what makes your solutions unique or interesting, if they are.

Programs on diskette (1541 format only) are welcome, but they must be accompanied by listings. You must enclose a stamped, self-addressed envelope if you want any of your materials returned. Solutions received by the middle of the month shown on the magazine cover are most likely to be discussed, but you may send solutions and comments any time. Your original programming problems, suggestions, and ideas are equally welcome. The best ones will become *Commodares*!

PROBLEM #51-1: UNLISTED NUMBERS

This problem was submitted by Douglas Raynor Jr. (Ft. Benning, GA). Write a BASIC program which can be added to another program making it impossible to LIST the program. Let's see versions for the C-64 and the C-128.

PROBLEM #51-2: DOUBLE SORT

Try this one from Don Monson (White Rock, BC). The user specifies a list of words. The program sorts the words by length and then subsorts the letters of each word alphabetically. For example, the list of words YES, COMMODARES, ARE, FUN, EVA is sorted and displayed in the following manner:

```
AER           ARE
AEV           EVA
ESY           YES
FNU           FUN
ACDEMMOORS    COMMODARES
```

Notice that equal-length words are sorted according to their alphabetized letters. (Perhaps this is really a triple sort?)

PROBLEM #51-3: SQUARED CIRCLES

This one from Ernie Turner (Columbia, MS) looks like fun. Fill a 3-inch square with as many ½-inch diameter circles as possible. The circles do not overlap. What is the total amount of unfilled space? Ernie implies that this is tough. What do you think?

PROBLEM #51-4: CRYPTIC PRODUCT

Write a program to solve this multiplication problem:

ABC * DE = FGHIJ

Each letter from A to J represents a single digit from 0 through 9, and C=2. (For an added challenge, are there any values that C can*not* be, assuming that all digits are represented?)

Before we start with the solutions to December's *Commodares*, let's take care of some old business. Charles Kluepfel (Bloomfield, NJ) pointed out that of the solutions to *Problem #43-3: Random Order* presented in the November 1987 issue, Paul Sobolik's solution was the most random. Searching in numerical order for the next unused value (as in some of the other algorithms discussed) will add some undesired order to the randomizing process. Thanks for the input, Charles.

Problems #47-1: Four Weights and *#47-2: Weighty Problem* were some heavy-duty challenges. Joe Butt (Knoxville, TN) suggested these classic balance-weight problems. The first problem was to let the computer come up with the four different weights the grocer needs to measure any object up to 40 pounds. Weights may be placed on the balance pan with the object being weighed, or they may be placed on the balance pan on the opposite side of the fulcrum.

Several readers let the computer do all the work. They created four nested FOR-NEXT loops to generate all combinations of four numbers (representing the four weights) from 1 to 40. Then a series of IF-THEN statements determined which groups of numbers could be combined to give every integer sum from 1 to 40. While these solutions are perfectly good and give the right answer, they are also rather lengthy and time-consuming. The results are weights of 1, 3, 9, and 27 pounds. These are consecutive powers of 3: 3 ↑ 0, 3 ↑ 1, 3 ↑ 2, and 3 ↑ 3.

Jim Speers (Niles, MI) used a process of inductive reasoning to solve the problem on paper. He found by trial and error that the solution for two weights gives 1 pound and 3 pounds. A third weight then must weigh objects from 5 pounds and up. The largest number which can be combined with 1 and 3 to give 5 is 9 (9−3−1=5). The numbers from 5 to 8 can also be weighed, since 1 and 3 give all values from 1 to 4. Values from 1 to 13 can be measured with 1, 3, and 9.

Continuing this line of reasoning, Jim looked for the largest number which could be used with 1, 3, and 9 to give 14: (X−9−3−1=14; X=27). Jim arrived at a general formula for the next weight to be added:

```
WT(X+1) = 1 + 2*(SUM of WTS(1...X))
```

Since the 3rd weight is 9, the 4th weight is

```
WT(3+1) = 1 + 2*(SUM of WTS(1...3))
        = 1 + 2*(1 + 3 + 9)
        = 1 + 2*13
        = 27
```

Jim found that this formula is equivalent to the formula WT (X+1)=3 ↑ X, thus agreeing with the earlier results that the weights are consecutive powers of 3.

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A few other readers recognized that this is a problem which can be readily solved using the base-3 number system. Unlike the base-2 (binary) system in which each digit is "on" or "off," this problem calls for a collection of weights which are used "on the same side as the object," "on the opposite side," or "on neither side."

Justin Smalley (Boulder, CO) printed this line in direct mode to find out which number system bases can be used to measure up to 40 pounds with only four weights:

```
FOR N=2 TO 10 : PRINT N; INT(LOG(40)/LOG
(N))+.1)+1 : NEXT
```

This loop prints the possible bases from 2 to 10 and as well as "one plus the mantissa of the base-N logarithm of 40." The results show that 40 can be represented by 4 digits or less in any base that is 3 or larger. (This should be understandable if you are familiar with binary math. In the binary system, a 4-digit number (4 bits) can represent the 16 integers from 0 to 15. The bit values are 1, 2, 4, and 8 with a sum of 15. If these values represent weights in pounds, combining the four weights would give a total of 15 pounds. Similarly, base-3 digits would have values 1, 3, 9, and 27 giving a sum of 40 pounds.)

In his program, Justin uses the formula above to calculate the number of weights needed (in base 3) for measuring any maximum weight MX.

```
•1 REM ====================================
•2 REM    COMMODARES PROBLEM #47-1 :
•3 REM      FOUR WEIGHTS
•4 REM    SOLUTION BY
•5 REM      JUSTIN SMALLEY
•6 REM ====================================
•10 MX=40:BA=3
•15 NW=INT(LOG(MX)/LOG(BA)+.1)+1
•20 FORI=1TONW:W(I)=INT(BA[UPARROW](I-1)+
 .1):S(I)=S(I-1)+W(I):NEXT:DIMN(MX,NW):K=
 1
•25 REM
•30 FORW=1TOMX
•35 D=W-W(K):IFW>S(K)THENK=K+1:GOTO35
•40 N(W,1)=W(K):S=SGN(D):D=ABS(D)
•45 FORI=2TONW:N(W,I)=S*N(D,I-1):NEXTI,W
•50 REM
•55 FORW=1TOMX:TT=20:IFINT(W/2)*2<>WTHENT
 T=0:PRINT
•60 PRINTTAB(TT)W"=";:FORJ=1TONW:PRINTN(W
 J);:NEXTJ,W:END
```

The loop at line 20 fills the array W( ) with the base-3 digits 1, 3, 9, and 27 representing the four weights. S( ) stores the cumulative sum of the digits, 1, 4, 13, and 40. The loop at line 30 converts each weight from 1 to 40 to its equivalent base-3 representation and stores the results in N( ).

A positive weight value goes on the balance opposite the object being weighed. A negative weight goes on the same side as the object. A value of zero means that the particular weight is not used. The loop at line 55 prints the weights of the 40 objects and the corresponding weights used. For example, the output:

```
15 = 27  -9  -3  0
```

means that to measure a 15 pound object, put the 27 pound weight on the opposite side and put the 3 and 9 pound weights on the same side as the object. The 1 pound weight is not used.

This short program from David Hoffner (Brooklyn, NY) displays the 40 objects and the positions of the weights used:

```
•1 REM ====================================
•2 REM    COMMODARES PROBLEM #47-2 :
•3 REM      WEIGHTY PROBLEM
•4 REM    SOLUTION BY
•5 REM      DAVID HOFFNER
•6 REM ====================================
•10 FORW=1TO40:PRINTW:F=W:FORN=0TO3:S=INT
 (F/3):T=INT(3.1*(F/3-S))+C
•20 IFT=1ORT=2THENPRINTTAB(T*5)3[UPARROW]
 N
•30 C=-(T>1):F=S:NEXTN,W
```

The object weight is printed in the left column. The middle column represents the weights placed opposite the object, and the right hand column shows weights placed on the same side as the object.

An interesting discussion of the base 3 number system (called the "ternary" system) is presented in Martin Gardner's *Sixth Book of Mathematical Games from Scientific American,* (Scribner's, 1971).

Congratulations also to Craig Ewert (Crystal Lake, IL), Jim Speers (Niles, MI), Larry Cox (Tecumseh, MI), Robert Marcus (Agincourt, ONT), and Wallace Leeker (Lemay, MO) for their solutions to these problems.

Dan Balint suggested *Problem #47-3: Joyful Sprite.* By the time you saw the problem it had become Joyful Spirits. In any case, the problem was to write a bare-bones program which lets the user move a sprite around on the screen with a joystick.

BASIC 7.0 on the C-128 does most of the work in solving this problem, as this program from Wallace Leeker (Lemay, MO) shows.

```
•1 REM ====================================
•2 REM   COMMODARE PROBLEM #47-3 :
•3 REM    JOYFUL SPIRITS
•4 REM   SOLUTION BY
•5 REM    WALLACE LEEKER
•6 REM ===== C-128 ONLY ===============
•10 DATA 0,112,0,0,248,0,1,252,0,3,54,0,3
 ,254,0,3,238,0,1,196,0,0,232,0,3,254,8,1
 5,255,28,63,255,140,119,255,252,119,255
•20 DATA240,63,255,192,63,255,192,7,255,1
 92,7,255,192,3,255,224,0,255,248,0,31,25
 2,0,1,254,0,0,0,0,0,0,0,0,0
•40 FORC=3584TO3648:READA:POKEC,A:NEXT
•50 GRAPHIC1,1
•60 SPRITE1,1,2,0,0,0,0
•70 MOVSPR1,150,150
```

```
•80 DO:A=JOY(1):IFA=0 OR A>8THEN LOOP
•90 Z=(A-1)*45
•100 MOVSPR1,1;Z
•110 LOOP
```

True to the spirit of the problem, Wallace's sprite is a ghostly shape defined by the DATA statements in lines 10 and 20. Wallace said that he used the C-128's SPRDEF sprite editor to create the shape. He then entered the Monitor to write down the data in memory locations $0E00 - $0E40 which correspond to Sprite 1. He used the DEC(A$) function to convert the hexadecimal values shown by the Monitor into the decimal values given in the DATA statements.

Line 40 puts the data into the Sprite 1 memory. Line 50 selects graphics mode, and line 60 displays the sprite and gives it color. Line 70 puts it into the center of the screen. Line 90 converts the joystick values from 0 to 8 into angles from 0 to 360. The MOVSPR command in line 100 uses the (distance;angle) parameters to move the sprite. This is repeated continuously from line 80.

The joystick should be in Port 1. Pressing the button will cause the joystick value to be outside the range 0 through 8, and the sprite will stop.

An alternative to copying the sprite data into DATA statements is to "capture" the sprite data from the screen. Douglas Raynor Jr. (Ft. Benning, GA) used this method to create a sprite. He used DRAW and PAINT to display the sprite's shape in the upper left corner of the screen. Then he used these statements:

```
SSHAPE A$,1,1,24,21
SPRSAV A$,1
SPRITE 1,1,6,0,0,0,0
MOVSPR 1,140,80
```

The SSHAPE statement stores the bit-map data from (1,1) to (24,21) on the screen in variable A$. The SPRSAV statement copies this data from A$ into the proper sprite 1 memory locations. The SPRITE statement turns the sprite on and sets its color, priority, size, and mode. This MOVSPR command uses absolute coordinates to position the sprite rather than the distance/angle format that Wallace used.

This program from Casey Riley (Smith, Nevada) shows that solving the problem on a C-64 is not really that much more difficult.

```
•1 REM ==================================
•2 REM   COMMODARE PROBLEM #47-3 :
•3 REM    JOYFUL SPIRITS
•5 REM    CASEY RILEY
•6 REM ==================================
•10 PRINT CHR$(147):V=53248:X=100:Y=150:F
 OR D=832 TO 832+63 : POKE D,255  : NEXT
•20 POKE 2040,13 :POKE V+21,1:POKE V+39,1
•30 POKE V,X : POKE V+1,Y
•40 C=PEEK(56320) :REM JOYSTICK IN PORT 2
•50 IF (C AND 1)=0 THEN Y=Y-1
•60 IF (C AND 2)=0 THEN Y=Y+1
•70 IF (C AND 4)=0 THEN X=X-1
•80 IF (C AND 8)=0 THEN X=X+1
•85 GOTO 30
•89 REM OPTIONAL BOUNDARIES (DELETE LINE
 85)
•90 IF Y<30 THEN Y=30
•100 IF Y>229 THEN Y=229
•110 IF X<1 THEN X=1
•120 IF X>255 THEN X=255
•130 GOTO 30
```

Line 10 clears the screen, then fills 64 locations starting at address 832 with 255's. This will be the sprite data (all bits are set). Line 20 sets the sprite 0 data pointer to location 832 (13 * 64 = 832). The VIC register at V+21 enables the sprite. The register at V+39 sets the color of the sprite.

The main loop begins at line 30. VIC registers at 53248 and 53249 are sprite 0's X and Y screen locations. Line 40 reads the joystick in Port 2. Moving the joystick up, down, right, or left sets bits 0, 1, 2, or 3 of address 56320. These bits correspond to the values 1, 2, 4, and 8 as shown in lines 50 through 80. Line 85 repeats the loop.

You should delete line 85 so that the boundary checking routine starting at line 90 is executed. Otherwise the values of X and Y will become too large (>255) or too small (<0) and give an illegal quantity error.

If you would like to see Wallace Leeker's spritely spirit on your C-64, replace the POKE D,255 in line 10 with READ K : POKE D,K and add Wallace's DATA statements from the previous program as lines 210 and 220.

Adam Grayer (Toms River, NJ) added a feature to his program. Pressing the fire button of the joystick causes the sprite to change color at random. You can easily modify the program above to do this with the following line:

```
45 IF (C AND 16)=0 THEN POKE V+39,INT(RN
D(1)*16)+1
```

Recall that V+39 is the color location for sprite 0. Bit 4 of address 56320 is 0 whenever the button is pressed. The expression (C AND 16) looks at just that bit.

The final challenge this month was *Problem #47-4: Musical Joys.* The idea was to use the joystick to control some sounds with the joystick. There were no C-64 solutions. This short program from Darrin Batten (Mineral Wells, WV) gives a "space ship slide whistle" effect on the C-128.

```
•1 REM ================================
•2 REM     PROBLEM #47-4 :
•3 REM      MUSICAL JOYS
•4 REM     SOLUTION BY
•5 REM      DARRIN BATTEN
•6 REM ================================
•10 X=2960:Y=2860:Z=2760
•20 DO
•30 IF JOY(2)=1 THEN X=X+90 : Y=Y+90 : Z=
Z+90
•40 IF JOY(2)=5 THEN X=X-90 : Y=Y-90 : Z=
Z-90
•50 IF Z<=90 THEN 80
•60 IF Z=>65500 THEN 80
•70 SOUND 1,X,2.33 : SOUND 2,Y,2.33 : SOU
ND 3,Z,2.33
•80 LOOP
```

Put the joystick into Port 2. Pulling back on the stick lowers the pitch and pushing forward raises the pitch. The frequencies of the three voices are close together, causing a "beating" effect (see *Rupert Report* this month for more on the subject).

This little program from Jim Speers gives your creativity more leeway.

```
•1 REM ================================
•2 REM     PROBLEM #47-4 :
•3 REM      MUSICAL JOYS
•4 REM     SOLUTION BY
•5 REM      JIM SPEERS
•6 REM ================================
•100 FORI=1TO8:READO$(I),N$(I):NEXT
•110 DATA O4,C,O4,D,O4,E,O4,F,O4,G,O4,A,O
4,B,O5,C
•120 FORI=0TO9:READE$(I):NEXT
•130 DATA T0,T1,T2,T3,T4,T5,T6,T7,T8,T9
•140 DEFFNE(X)=X+1+10*(X=9):DEFFNT(X)=X+2
+24*(X=24):E=1:T=8:TEMPO T
•150 PRINT"[CLEAR][5"[DOWN]"]"TAB(13)"[RV
SON]  IT'S ON !! [RVSOFF]":PRINT"[DOWN]"
TAB(14)"[RVSON]  PLAY IT!  [RVSOFF]"
•160 J=JOY(2):FORI=1TO50:NEXTI:IFJ<128THE
N220
•170 FORI=1TO50:NEXTI:TM=TI+60
•180 J=JOY(2):IFJ>127THEN210
•190 IFTM>TITHEN180
•200 E=FNE(E):GOTO160
•210 T=FNT(T):TEMPO T:GOTO 160
•220 IF J=0 THEN 160
•230 X$="V1"+O$(J)+E$(E)+N$(J):PLAY X$:FO
RI=1TO200:NEXT:GOTO160
```

The eight positions of the joystick are assigned notes of the scale. Low C is at 12 o'clock, and the rest of the notes are clockwise around the joystick. Jim says that hitting the fire button once cycles through the ten envelopes. Hitting it twice, not too rapidly but not too slowly, cycles through the tempos. You may want to add a PRINT E or PRINT T statement to line 160 to keep track of envelope and tempo.

Don't confuse the O's with zeros. You may increase the delay value in the I loop of line 230 to reduce the chance of repeating unwanted notes.

Congratulations to the following readers with solutions not already mentioned this month: Herbert Schlickenmaier (Alexandria, VA), Andrew Rosenthal (Flushing, NY), Jeffrey Clemovich (Schenectady, NY), and Tom Daniels (Woodinville, WA). □

PROGRAM LISTINGS

Attention new *Ahoy!* readers! You must read the following information very carefully prior to typing in programs listed in *Ahoy!* Certain Commodore characters, commands, and strings of characters and commands will appear in a special format. Follow the instructions and listings guide on this page.

On the following pages you'll find several programs that you can enter on your Commodore computer. But before doing so, read this entire page carefully.

To insure clear reproductions, *Ahoy!'s* program listings are generated on a daisy wheel printer, incapable of printing the commands and graphic characters used in Commodore programs. These are therefore represented by various codes enclosed in brackets [ ]. For example: the SHIFT CLR/HOME command is represented onscreen by a heart . The code we use in our listings is [CLEAR]. The chart below lists all such codes which you'll encounter in our listings, except for one other special case.

The other special case is the COMMODORE and SHIFT characters. On the front of most keys are two symbols. The symbol on the left is obtained by pressing that key while holding down the COMMODORE key; the symbol on the right, by pressing that key while holding down the SHIFT key. COMMODORE and SHIFT characters are represented in our listings by a lower-case "s" or "c" followed by the symbol of the key you must hit. COMMODORE J, for example, is represented by [c J], and SHIFT J by [s J].

Additionally, any character that occurs more than two times in a row will be displayed by a coded listing. For example, [3 "[LEFT]"] would be 3 CuRSoR left commands in a row, [5 "[s EP]"] would be 5 SHIFTed English Pounds, and so on. Multiple blank spaces will be noted in similar fashion: e.g., 22 spaces as [22 " "].

Sometimes you'll find a program line that's too long for the computer to accept (C-64 lines are a maximum of 80 characters, or 2 screen lines long; C-128 lines, a maximum of 160 characters, 2 or 4 screen lines in 40 or 80 columns respectively). To enter these lines, refer to the *BASIC Command Abbreviations Appendix* in your User Manual.

On the next page you'll find our *Bug Repellent* programs for the C-128 and C-64. The version for your machine will help you proofread programs after typing them. (Please note: the *Bug Repellent* line codes that follow each program line, in the whited-out area, should *not* be typed in. See instructions preceding each program.)

On the second page following you will find *Flankspeed*, our ML entry program, and instructions on its use.

Call *Ahoy!* at 212-239-6089 with any problems (if busy or no answer after three rings, call 212-239-0855).

WHEN YOU SEE	IT MEANS	YOU TYPE		YOU WILL SEE
[CLEAR]	Screen Clear	SHIFT	CLR/HOME	
[HOME]	Home		CLR/HOME	
[UP]	Cursor Up	SHIFT	↑ CRSR ↓	
[DOWN]	Cursor Down		↑ CRSR ↓	
[LEFT]	Cursor Left	SHIFT	← CRSR →	
[RIGHT]	Cursor Right		← CRSR →	
[SS]	Shifted Space	SHIFT	Space	
[INSERT]	Insert	SHIFT	INST/DEL	
[DEL]	Delete		INST/DEL	
[RVSON]	Reverse On	CNTRL	9	
[RVSOFF]	Reverse Off	CNTRL	0	
[UPARROW]	Up Arrow		↑	↑
[BACKARROW]	Back Arrow		←	←
[PI]	PI		π	π
[EP]	English Pound		£	£

WHEN YOU SEE	IT MEANS	YOU TYPE	YOU WILL SEE
[BLACK]	Black	CNTRL 1	
[WHITE]	White	CNTRL 2	
[RED]	Red	CNTRL 3	
[CYAN]	Cyan	CNTRL 4	
[PURPLE]	Purple	CNTRL 5	
[GREEN]	Green	CNTRL 6	
[BLUE]	Blue	CNTRL 7	
[YELLOW]	Yellow	CNTRL 8	
[F1]	Function 1	F1	
[F2]	Function 2	SHIFT F1	
[F3]	Function 3	F3	
[F4]	Function 4	SHIFT F3	
[F5]	Function 5	F5	
[F6]	Function 6	SHIFT F5	
[F7]	Function 7	F7	
[F8]	Function 8	SHIFT F7	

BUG REPELLENT FOR THE 64 & 128 By BUCK CHILDRESS

Please note: the *Bug Repellent* programs listed here are for *Ahoy!* programs published from the May 1987 issue onward! For older programs, use the older version.

Type in, save, and run *Bug Repellent*. You'll be asked if you want automatic saves to take place. If so, you're prompted for the device, DISK (D) or TAPE (T). You then pick a starting file number, 0 through 99. Next, you enter a name, up to 14 characters long. At this point, *Bug Repellent* verifies your entries and gives you a chance to change them if you want. If no changes are needed, *Bug Repellent* activates itself. (Pressing RETURN without answering the prompts defaults to disk drive and begins your files with "00BACKUP".)

Type NEW and begin entering an *Ahoy!* program. As you enter program lines and press RETURN, a *Bug Repellent* code appears at the top of your screen. If it doesn't match the code in the program listing, an error exists. Correct the line and the codes will match.

If used, automatic saves take place every 15 minutes. When the RETURN key is pressed on a program line, the screen changes color to let you know that a save will begin in about three seconds. You may cancel the save by pressing the RUN STOP key. The file number increments after each save. It resets to 00 if 99 is surpassed. After saving, or cancelling, the screen returns to its original color and the timer resets for 15 minutes.

When you've finished using *Bug Repellent*, deactivate it by typing SYS 49152 [RETURN] for the Commodore 64 or SYS 4864 [RETURN] for the Commodore 128.

C-64 BUG REPELLENT

```
·10 PRINTCHR$(147)"LOADING AND CHECKING THE DATA[3"."]":J
=49152
·20 FORB=0TO11:READA:IFA<0ORA>255THEN40
·30 POKEJ+B,A:X=X+A:NEXTB:READA:IFA=XTHEN50
·40 PRINT:PRINT"ERROR IN DATA LINE:"PEEK(64)*256+PEEK(63)
:END
·50 X=0:J=J+12:IFJ<49456THEN20
·60 POKE198,0:POKE49456,0:A$="Y":B$=A$:C$="D":D$="DISK":D
=8:PRINTCHR$(147)
·70 INPUT"DO YOU WANT AUTOMATIC SAVES (Y/N)";A$:PRINT:IFA
$="Y"THEN90
·80 PRINT"NO AUTOMATIC SAVES[3"."]":GOTO150
·90 POKE49456,1:INPUT"DISK OR TAPE (D/T)";C$:IFC$<>"D"THE
ND=1:D$="TAPE"
·100 POKE49457,D:D$=D$+" DRIVE":PRINT:INPUT"FILE NUMBER (
0-99)";N
·110 N$=RIGHT$(STR$(N),2):IFN<10THENN$=CHR$(48)+CHR$(N+48
)
·120 F$="BACKUP":PRINT:INPUT"FILENAME";F$:F$=N$+LEFT$(F$,
14):L=LEN(F$)
·130 POKE49458,L:FORJ=1TOL:POKE49458+J,ASC(MID$(F$,J,1)):
NEXTJ:PRINT
·140 PRINT"SAVING DEVICE ** "D$:PRINT"STARTING WITH ** "F
$
·150 PRINT:INPUT"IS THIS CORRECT (Y/N)";B$:IFB$<>"Y"THEN6
0
·160 POKE770,131:POKE771,164:SYS49152:END
·170 DATA169,79,32,210,255,162,38,160,192,204,3,3,1507
·180 DATA208,10,162,131,160,164,169,70,32,210,255,44,1615
·190 DATA169,78,32,210,255,142,2,3,140,3,3,76,1113
·200 DATA36,193,32,96,165,134,122,132,123,32,115,0,1180
·210 DATA170,240,243,162,255,134,58,144,3,76,150,164,1799
·220 DATA32,107,169,32,121,165,173,0,2,240,5,169,1215
·230 DATA79,141,2,3,76,162,164,169,0,133,2,133,1064
·240 DATA251,133,252,133,254,24,101,20,69,254,230,254,197
5
·250 DATA24,101,21,69,254,170,230,254,164,252,185,0,1724
·260 DATA2,133,253,201,34,208,6,165,2,73,255,133,1465
·270 DATA2,201,32,208,4,165,2,240,8,138,24,101,1125
·280 DATA253,69,254,170,44,198,254,230,252,164,253,208,23
49
·290 DATA213,138,41,240,74,74,74,74,24,105,129,141,1327
·300 DATA44,193,138,41,15,24,105,129,141,45,193,162,1230
·310 DATA0,189,43,193,240,12,157,0,4,173,134,2,1147
·320 DATA157,0,216,232,208,239,169,38,141,2,3,173,1578
·330 DATA48,193,240,23,165,161,201,212,176,4,165,160,1748
·340 DATA240,13,238,32,208,160,0,32,225,255,208,6,1617
·350 DATA32,33,193,76,38,192,232,208,242,200,208,239,1893
·360 DATA32,68,229,169,0,168,174,49,193,32,186,255,1555
·370 DATA173,50,193,162,51,160,193,32,189,255,169,43,1670
·380 DATA166,45,164,46,32,216,255,162,1,189,51,193,1520
·390 DATA168,200,152,201,58,144,2,169,48,157,51,193,1543
·400 DATA201,48,208,3,202,16,234,32,33,193,76,116,1362
·410 DATA164,206,32,208,169,0,170,168,76,219,255,160,1827
·420 DATA1,1,160,0,0,65,72,79,89,33,0,0,500
```

C-128 BUG REPELLENT

```
·10 PRINTCHR$(147)"LOADING AND CHECKING THE DATA[3"."]":J
=4864
·20 FORB=0TO11:READA:IFA<0ORA>255THEN40
·30 POKEJ+B,A:X=X+A:NEXTB:READA:IFA=XTHEN50
·40 PRINT:PRINT"ERROR IN DATA LINE:"PEEK(66)*256+PEEK(65)
:END
·50 X=0:J=J+12:IFJ<5213THEN20
·60 POKE208,0:POKE5213,0:A$="Y":B$=A$:C$="D":D$="DISK":D=
8:PRINTCHR$(147)
·70 INPUT"DO YOU WANT AUTOMATIC SAVES (Y/N)";A$:PRINT:IFA
$="Y"THEN90
·80 PRINT"NO AUTOMATIC SAVES[3"."]":GOTO150
·90 POKE5213,1:INPUT"DISK OR TAPE (D/T)";C$:IFC$<>"D"THEN
D=1:D$="TAPE"
·100 POKE5214,D:D$=D$+" DRIVE":PRINT:INPUT"FILE NUMBER (0
-99)";N
·110 N$=RIGHT$(STR$(N),2):IFN<10THENN$=CHR$(48)+CHR$(N+48
)
·120 F$="BACKUP":PRINT:INPUT"FILENAME";F$:F$=N$+LEFT$(F$,
14):L=LEN(F$)
·130 POKE5215,L:FORJ=1TOL:POKE5215+J,ASC(MID$(F$,J,1)):NE
XTJ:PRINT
·140 PRINT"SAVING DEVICE ** "D$:PRINT"STARTING WITH ** "F
$
·150 PRINT:INPUT"IS THIS CORRECT (Y/N)";B$:IFB$<>"Y"THEN6
0
·160 POKE770,198:POKE771,77:SYS4864:END
·170 DATA32,58,20,169,41,162,19,236,3,3,208,4,955
·180 DATA169,198,162,77,141,2,3,142,3,3,224,19,1143
·190 DATA208,7,32,125,255,79,78,0,96,32,125,255,1292
·200 DATA79,70,70,0,96,162,0,134,251,189,0,2,1053
·210 DATA240,19,201,48,144,9,201,58,176,5,133,251,1485
·220 DATA232,208,238,134,252,165,251,208,3,76,198,77,2042
·230 DATA169,0,166,235,164,236,133,253,133,254,142,47,193
2
·240 DATA20,140,48,20,24,101,22,69,254,230,254,24,1206
·250 DATA101,23,69,254,170,230,254,164,252,185,0,2,1704
·260 DATA133,251,201,34,208,6,165,253,73,255,133,253,1965
·270 DATA201,32,208,4,165,253,240,8,138,24,101,251,1625
·280 DATA69,254,170,44,198,254,230,252,164,251,208,213,23
07
·290 DATA138,41,240,74,74,74,74,24,105,65,141,88,1138
·300 DATA20,138,41,15,24,105,65,141,89,20,32,79,769
·310 DATA20,189,85,20,240,6,32,210,255,232,208,245,1742
·320 DATA174,47,20,172,48,20,24,32,240,255,173,93,1298
·330 DATA20,240,27,165,161,201,212,176,4,165,160,240,1771
·340 DATA17,32,65,20,238,32,208,238,1,214,32,225,1322
·350 DATA255,208,6,32,49,20,76,198,77,232,208,242,1603
·360 DATA200,208,239,32,66,193,173,95,20,162,96,160,1644
·370 DATA20,32,189,255,169,0,170,32,104,255,169,0,1395
·380 DATA174,94,20,168,32,186,255,169,45,174,16,18,1351
·390 DATA172,17,18,32,216,255,162,1,189,96,20,168,1346
·400 DATA200,152,201,58,144,2,169,48,157,96,20,201,1448
·410 DATA48,208,3,202,16,234,32,49,20,141,0,2,955
·420 DATA76,183,77,58,59,32,65,20,206,32,208,206,1222
·430 DATA1,214,169,0,170,168,76,219,255,32,79,20,1403
·440 DATA169,26,141,0,214,173,0,214,16,251,96,162,1462
·450 DATA0,142,0,255,96,19,18,32,32,32,32,146,804
·460 DATA0,1,0,0,65,72,79,89,33,0,0,0,339
```

FLANKSPEED FOR THE C-64 By GORDON F. WHEAT

Flankspeed will allow you to enter machine language *Ahoy!* programs without any mistakes. Once you have typed the program in, save it for future use. While entering an ML program with *Flankspeed* there is no need to enter spaces or hit the carriage return. This is all done automatically. If you make an error in a line a bell will ring and you will be asked to enter it again. To LOAD in a program Saved with *Flankspeed* use LOAD "name",1,1 for tape, or LOAD "name",8,1 for disk. The function keys may be used after the starting and ending addresses have been entered.

f1–SAVEs what you have entered so far.

f3–LOADs in a program worked on previously.

f5–To continue on a line you stopped on after LOADing in the previous saved work.

f7–Scans through the program to locate a particular line, or to find out where you stopped the last time you entered the program. It temporarily freezes the output as well.

```
·100 POKE53280,12:POKE53281,11                                 OP
·105 PRINT"[CLEAR][c 8][RVSON][15" "]FLANKSPEED[15" "]";       FP
·110 PRINT"[RVSON][5" "]MISTAKEPROOF ML ENTRY PROGRAM[6" "
 ]"                                                            JP
·115 PRINT"[RVSON][9" "]CREATED BY G. F. WHEAT[9" "]"          FA
·120 PRINT"[RVSON][3" "]COPR. 1987, ION INTERNATIONAL INC.
 [3" "]"                                                       AJ
·125 FORA=54272TO54296:POKEA,0:NEXT                            ND
·130 POKE54272,4:POKE54273,48:POKE54277,0:POKE54278,249:PO
 KE54296,15                                                    NP
·135 FORA=680TO699:READB:POKEA,B:NEXT                          FL
·140 DATA169,251,166,253,164,254,32,216,255,96                 FF
·145 DATA169,0,166,251,164,252,32,213,255,96                   EK
·150 B$="STARTING ADDRESS IN HEX":GOSUB430:AD=B:SR=B           KP
·155 GOSUB480:IFB=0THEN150                                     OE
·160 POKE251,T(4)+T(3)*16:POKE252,T(2)+T(1)*16                 AM
·165 B$="ENDING ADDRESS IN HEX":GOSUB430:EN=B                  PE
·170 GOSUB470:IFB=0THEN150                                     PG
·175 POKE254,T(2)+T(1)*16:B=T(4)+1+T(3)*16                     GM
·180 IFB>255THENB=B-255:POKE254,PEEK(254)+1                    HG
·185 POKE253,B:PRINT                                           EC
·190 REM  GET HEX LINE                                         ED
·195 GOSUB495:PRINT": [c P][LEFT]";:FORA=0TO8                  KD
·200 FORB=0TO1:GOTO250                                         IH
·205 NEXTB                                                     IJ
·210 A%(A)=T(1)+T(0)*16:IFAD+A-1=ENTHEN340                     FA
·215 PRINT" [c P][LEFT]";                                      EG
·220 NEXTA:T=AD-(INT(AD/256)*256):PRINT" "                     II
·225 FORA=0TO7:T=T+A%(A):IFT>255THENT=T-255                    GL
·230 NEXT                                                      GI
·235 IFA%(8)<>TTHENGOSUB375:GOTO195                            FL
·240 FORA=0TO7:POKEAD+A,A%(A):NEXT:AD=AD+8:GOTO195             IM
·245 REM    GET HEX INPUT                                      PA
·250 GETA$:IFA$=""THEN250                                      GA
·255 IFA$=CHR$(20)THEN305                                      GO
·260 IFA$=CHR$(133)THEN535                                     LM
·265 IFA$=CHR$(134)THEN560                                     IG
·270 IFA$=CHR$(135)THENPRINT" ":GOTO620                        HO
·275 IFA$=CHR$(136)THENPRINT" ":GOTO635                        HE
·280 IFA$>"@"ANDA$<"G"THENT(B)=ASC(A$)-55:GOTO295              MI
·285 IFA$>"/"ANDA$<":"THENT(B)=ASC(A$)-48:GOTO295              DJ
·290 GOSUB415:GOTO250                                          JA
·295 PRINTA$"[c P][LEFT]";                                     PK
·300 GOTO205                                                   FA
·305 IFA>0THEN320                                              BI
·310 A=-1:IFB=1THEN330                                         BB
·315 GOTO220                                                   FA
·320 IFB=0THENPRINTCHR$(20);CHR$(20);:A=A-1                    BF
·325 A=A-1                                                     FK
·330 PRINTCHR$(20);:GOTO220                                    PH
·335 REM LAST LINE                                             CP
·340 PRINT" ":T=AD-(INT(AD/256)*256)                           KH
·345 FORB=0TOA-1:T=T+A%(B):IFT>255THENT=T-255                  OD
·350 NEXT                                                      OB
·355 IFA%(A)<>TTHENGOSUB375:GOTO195                            LH
·360 FORB=0TOA-1:POKEAD+B,A%(B):NEXT                           BO
·365 PRINT:PRINT"YOU ARE FINISHED!":GOTO535                    MB
·370 REM BELL AND ERROR MESSAGES                               LM
·375 PRINT:PRINT"LINE ENTERED INCORRECTLY":PRINT:GOTO415       JK
·380 PRINT:PRINT"INPUT A 4 DIGIT HEX VALUE!":GOTO415           PG
·385 PRINT:PRINT"ENDING IS LESS THAN STARTING!":B=0:GOTO41
 5                                                             IK
·390 PRINT:PRINT"ADDRESS NOT WITHIN SPECIFIED RANGE!":B=0:
 GOTO415                                                       HK
·395 PRINT:PRINT"NOT ZERO PAGE OR ROM!":B=0:GOTO415            DM
·400 PRINT"?ERROR IN SAVE":GOTO415                             JK
·405 PRINT"?ERROR IN LOAD":GOTO415                             IO
·410 PRINT:PRINT:PRINT"END OF ML AREA":PRINT                   JO
·415 POKE54276,17:POKE54276,16:RETURN                          BF
·420 OPEN15,8,15:INPUT#15,A,A$:CLOSE15:PRINTA$:RETURN          DH
·425 REM GET FOUR DIGIT HEX                                    IM
·430 PRINT:PRINTB$;:INPUTT$                                    OL
·435 IFLEN(T$)<>4THENGOSUB380:GOTO430                          JD
·440 FORA=1TO4:A$=MID$(T$,A,1):GOSUB450:IFT(A)=16THENGOSUB
 380:GOTO430                                                   AK
·445 NEXT:B=(T(1)*4096)+(T(2)*256)+(T(3)*16)+T(4):RETURN       KB
·450 IFA$>"@"ANDA$<"G"THENT(A)=ASC(A$)-55:RETURN               GM
·455 IFA$>"/"ANDA$<":"THENT(A)=ASC(A$)-48:RETURN               NJ
·460 T(A)=16:RETURN                                            IC
·465 REM ADDRESS CHECK                                         OL
·470 IFAD>ENTHEN385                                            HO
·475 IFB<SRORB>ENTHEN390                                       LE
·480 IFB<256OR(B>40960ANDB<49152)ORB>53247THEN395              OB
·485 RETURN                                                    HE
·490 REM ADDRESS TO HEX                                        PM
·495 AC=AD:A=4096:GOSUB520                                     AP
·500 A=256:GOSUB520                                            NF
·505 A=16:GOSUB520                                             LG
·510 A=1:GOSUB520                                              HE
·515 RETURN                                                    JD
·520 T=INT(AC/A):IFT>9THENA$=CHR$(T+55):GOTO530                OC
·525 A$=CHR$(T+48)                                             JI
·530 PRINTA$;:AC=AC-A*T:RETURN                                 AA
·535 A$="**SAVE**":GOSUB585                                    IC
·540 OPEN1,T,1,A$:SYS680:CLOSE1                                AB
·545 IFST=0THENEND                                             FB
·550 GOSUB400:IFT=8THENGOSUB420                                PM
·555 GOTO535                                                   FI
·560 A$="**LOAD**":GOSUB585                                    PE
·565 OPEN1,T,0,A$:SYS690:CLOSE1                                PO
·570 IFST=64THEN195                                            OI
·575 GOSUB405:IFT=8THENGOSUB420                                CO
·580 GOTO560                                                   GN
·585 PRINT" ":PRINTTAB(14)A$                                   KA
·590 PRINT:A$="":INPUT"FILENAME";A$                            IO
·595 IFA$=""THEN590                                            HK
·600 PRINT:PRINT"TAPE OR DISK?":PRINT                          HL
·605 GETB$:T=1:IFB$="D"THENT=8:A$="@0:"+A$:RETURN              NP
·610 IFB$<>"T"THEN605                                          KO
·615 RETURN                                                    PH
·620 B$="CONTINUE FROM ADDRESS":GOSUB430:AD=B                  DD
·625 GOSUB475:IFB=0THEN620                                     NK
·630 PRINT:GOTO195                                             HN
·635 B$="BEGIN SCAN AT ADDRESS":GOSUB430:AD=B                  FK
·640 GOSUB475:IFB=0THEN635                                     LN
·645 PRINT:GOTO670                                             HI
·650 FORB=0TO7:AC=PEEK(AD+B):GOSUB505:IFAD+B=ENTHENAD=SR:G
 OSUB410:GOTO195                                               LM
·655 PRINT" ";:NEXTB                                           LE
·660 PRINT:AD=AD+8                                             CD
·665 GETB$:IFB$=CHR$(136)THEN195                               JD
·670 GOSUB495:PRINT": ";:GOTO650                               KE
```

IMPORTANT! Letters on white background are **Bug Repellent** line codes. **Do not enter them!** Pages 73 and 74 explain these codes and provide other essential information on entering ***Ahoy!*** programs. Refer to these pages **before** entering any programs!

SYNTHESIZING WAVEFORMS
FROM PAGE 32

WAVEFORM SYNTHESIS

```
·1 REM==================================== NM
·2 REM       WAVEFORM SYNTHESIS          KA
·3 REM       RUPERT REPORT #51           OC
·4 REM                                   JF
·5 REM            C-128                  JH
·6 REM==================================== CL
·10 SS=.05             :REM GRAPH STEP SIZE KN
·20 GOSUB 400          :REM INITIALIZE   ND
·30 GOSUB 700          :REM MENU         DI
·40 GOSUB 600          :REM DRAW AXIS    GD
·50 GOSUB 200          :REM DRAW GRAPHS  EE
·60 GOTO 30                              CF
·70 END                                  MG
·200 REM ================ DRAW GRAPHS === OL
·210 HS=2 : IF WF=1 THEN HS=1   :REM STEP
 SIZE OF HARMONICS                       JF
·220 K2=1 : REM INITIAL FREQUENCY        LL
·230 DO                                  ND
·240 :IF WF=0 THEN K1=(-1)[UPARROW]((K2-1
)/2)/(K2*K2):ELSE K1=1/K2                PG
·250 :CHAR 1,25,1,"HARMONIC #"+STR$(K2)  FO
·260 :N=0                                GM
·270 :FOR X=WL TO WR STEP SS             CG
·280 ::IF K2=1 THEN Y(N)=0 : ELSE DRAW 0,
X0(N),Y0(N) :REM ERASE PREVIOUS GRAPH    JO
·281 REM -- DELETE THE FOLLOWING REM'S TO
 PLOT INDIVIDUAL HARMONICS               BE
·282 REM  Y=K1*SIN(X*K2)                 PF
·283 REM  XS=A*X+B : YS=200-(C*Y+D)      CA
·284 REM  DRAW 1,XS,YS                   KF
·290 ::Y=Y(N)+K1*SIN(X*K2)        :REM SUM
 HARMONICS                               ON
·300 ::Y(N)=Y              :REM SAVE RESULT MG
·310 ::XS=A*X+B :YS=200-(C*Y+D):REM SCALE
 DATA FOR GRAPHING                       LE
·320 ::X0(N)=XS : Y0(N)=YS  :DRAW 1,XS,YS CF
·330 ::N=N+1                             PJ
·340 ::GET K$ : IF K$>"" THEN RETURN     DD
·350 :NEXT X                             HG
·360 :K2=K2+HS                           JC
·370 LOOP                                FP
·400 REM ====== INITIALIZATION ========== NJ
·410 Y=0 : K1=0 : K2=0 : X=0 : N=0       JB
·420 A=0 : B=0 : C=0 : D=0               ME
·430 GR=RGR(1) : IF GR>5 THEN GR=5       LB
·440 PI=3.14159265                       AE
·450 GRAPHIC 0,1 : SLOW                  JB
·460 REM ----- GRAPH CONSTANTS -----     AN
·470 REM WORLD COORDS: LEFT, RIGHT, TOP,
 BOTTOM                                  NL
·480 WL=0 : WR=2*PI : WT=1.6 : WB=-1.6   FC
·490 REM SCREEN COORDS: LEFT, RIGHT, TOP,
 BOTTOM                                  LC
·500 VL=60 : VR=252 : VT=180 : VB=40     CN
·510 A=(VR-VL)/(WR-WL) : B=VL-A*WL       ML
·520 C=(VT-VB)/(WT-WB) : D=VB-C*WB       MG
·530 DM=INT((WR-WL)/SS) :REM # OF POINTS KL
·540 DIM X0(DM),Y0(DM),Y(DM)             AH
·550 RETURN                              LG
·600 REM ==== DRAW VIEWPORT & AXIS ====== JF
·610 GRAPHIC 1,1                         MJ
·620 BOX 1,VL,200-VT,VR,200-VB           MA
·630 REM --- DRAW X AXIS ----            AJ
·640 Y=0 : XS=A*X+B : YS=200-(C*Y+D)     EA
·650 DRAW 1,VL,YS TO VR,YS               GM
·660 CHAR1,8,24,"PRESS ANY KEY TO RETURN" JK
·670 RETURN                              CO
·700 REM ============ MENU ============== PF
·710 GRAPHIC 0,1 : IF B4 THEN 890        NN
·720 WINDOW 0,0,39,24,1                  PH
·730 FOR N=1 TO 20 : PRINT "[s U][s I]";
 : NEXT : PRINT " ";                     ME
·740 FOR N=1 TO 19 : PRINT "[c Z][c X]";
 : NEXT                                  DB
·750 CHAR 1,10,2,"WAVEFORM SYNTHESIZER" :
 PRINT                                   OJ
·760 FOR N=1 TO 20 : PRINT "[c A][c S]";
 : NEXT : PRINT " ";                     FC
·770 FOR N=1 TO 19 : PRINT "[s J][s K]";
 : NEXT                                  HH
·780 WINDOW 5,6,35,24,1                  FL
·790 PRINT "COMBINE VARIOUS FREQUENCIES" NA
·800 PRINT "OF SINE WAVES TO SYNTHESIZE" GJ
·810 PRINT "OTHER WAVEFORMS."            FB
·820 WINDOW 10,12,30,24,1                NM
·830 PRINT "1. TRIANGLE WAVE"            DH
·840 PRINT "2. SAWTOOTH WAVE"            GB
·850 PRINT "3. SQUARE WAVE"              NB
·860 PRINT "4. QUIT"                     AB
·870 B4=-1  :REM DRAW MENU ONLY ONCE     JJ
·880 WINDOW 10,18,30,19,1                BI
·890 PRINT : PRINT "SELECT A NUMBER"     FO
·900 GETKEY K$ : V=VAL(K$)               GG
·910 IF V=0 OR V>4 THEN PRINT CHR$(7)  :
 GOTO 890 :REM BELL FOR BAD KEY          AJ
·920 IF V=4 THEN GRAPHIC 0,1 : WINDOW 0,0
,39,24,1 : GRAPHIC GR : END              DI
·930 WF=V-1 :REM WAVEFORM TYPE           HB
·940 RETURN                              DN
```

HEAR THE BEATS

```
·1 REM==================================== NM
·2 REM          HEAR THE BEATS           CD
·3 REM         RUPERT REPORT #51         OC
```

```
•4 REM                                        JF
•5 REM              C-128 ONLY                NL
•6 REM================================        CL
•10 PRINT "[CLEAR]"                           HP
•20 P1$= "FREQ 1 - FREQ 2 =  [3"#"] CYCLE
 S PER SECOND"                                DB
•30 P2$="1/(FREQ 1-FREQ 2) = ##.# SEC PER
  CYCLE"                                      NK
•40 K1=16.4    :REM 1 HZ                      NE
•50 F1=300*K1 : F2=F1-10*K1 :REM START AT
  300 AND 290 HZ                              JM
•60 PRINT TAB(5);"<><>  HEAR THE BEATS  <
><>"                                          DL
•70 PRINT                                     OB
•80 SOUND 1,F1,32000                          BK
•90 K=K1 : P$=P1$ : K2=0                      FI
•100 PRINT"EACH KEYSTROKE INCREASES FREQU
 ENCY 2"                                      CD
•110 PRINT TAB(5);"--PRESS ESCAPE TO EXIT
 --" : PRINT                                  JJ
•120 WINDOW 0,10,39,24,1                      KC
•130 DO                                       GP
•140 SOUND 2,F2,32000                         HI
•150 DF=(F1-INT(F2))/K1 :IF F1-F2<K1 THEN
  DF=1/DF                                     PH
•160 PRINT USING P$;DF   :REM PRINT F1;INT
 (F2)                                         BC
•170 GETKEY K$                                KM
•180 IF K$=CHR$(27) THEN 240 :REM ESCAPE=
 EXIT                                         AL
•190 POKE 4739,255 : POKE 4742,255   :REM
  RESET V2 TIMER                              FD
•200 IF F1-F2>2*K1 THEN F2=F2+K1  : ELSE
 K2=K2+1 : F2=F1-K1/K2 : P$=P2$               JG
•210 IF INT(F1)-INT(F2)<4 THEN PRINT"PRES
 S ANY KEY TO EXIT" :GETKEY K$ : GOTO 240     NL
•220 LOOP                                     MI
•230 REM ---- EXIT ----                       PP
•240 POKE 4738,255 : POKE 4741,255 :  REM
  V1 TIMER                                    DK
•250 POKE 4739,255 : POKE 4742,255 :  REM
  V2 TIMER                                    OL
•260 POKE 54276,0 : REM SILENCE V1            DK
•270 POKE 54283,0 : REM SILENCE V2            IN
•280 PRINT "[HOME][HOME][CLEAR]" :REM RES
 ET WINDOW                                    NE
```

VEE KLOROS
FROM PAGE 20

BASIC PORTION

```
•10 IFX=.THENX=1:LOAD"KLOROS.OBJ",8,1         DA
•20 POKE53281,.:POKE53280,.:PRINTCHR$(8)C
HR$(142)CHR$(144)CHR$(147):GOTO190            CJ
•30 POKES+U,Q:POKES+F,O:FORC=ZTO.STEP-U:P
OKES+U,C:FORA=.TOZ:NEXT:NEXT                  CO
•40 POKES+F,O-U:RETURN                        GL
•50 ONFNB(.)GOTO90:X=H+(C=130)*-U:SYSSF,B
(X):SC=SC+50*(LS+U):I$=STR$(SC)               GB
•60 SYSPL,32,8:PRINT"[YELLOW]";:GOSUB180      GC
•70 FORI=.TOF:POKEVB+X,38+I:FORA=.TO40:NE
XT:NEXT:POKEVB+X,51:GOSUB30                   MM
•80 RETURN                                    NO
•90 POKES+U,K:POKES,O:POKES+F,L*W+Z:POKEV
+F,PEEK(V):POKEV+Q,PEEK(V+U)-K                JI
•100 POKEV+Z,PEEK(V+Z)ORF:POKES+F,E*Z+U:R
ETURN                                         GA
•110 X=E+((C=Z-UORC=L)*-U):SYSSB,X,38,F:S
YSTF,B(X):SYSTC,H,RORB(X):POKEV+39+X,U        DL
•120 GOSUB30:WAITV+Z,B(X),B(X):SC=SC+VX*(
LS+U):I$=STR$(SC):SYSPL,32,8:PRINT"[YELL
OW]";                                         NA
•130 GOSUB180:R=8+(T<W)*-16:SYSSB,X,43,7:
SYSTC,H,R:POKEVB+X,50+(T>U)*N+(T>W)*-U        GC
•140 POKEV+X*W+U,.:POKEV+39+X,N-W:POKEV+Z
,PEEK(V+Z)ORB(X):C=PEEK(VC):RETURN            PO
•150 A=(RND(U)*W)+E:X=FNX(.):I=FNY(.)         LI
•160 SYSMD,Q,D(U+X,U+I):POKEV+VX,PEEK(V+A
*W):POKEV+VY,PEEK(V+A*W+U)                    PB
•170 POKEV+Z,PEEK(V+Z)ORB:RETURN              AJ
•180 PRINTRIGHT$("[5"0"]"+(RIGHT$(I$,LEN(
I$)-U)),Q):A=FRE(.):RETURN                    PH
•190 GOSUB1070:GOSUB1120:GOSUB740:POKE731
,2:POKE785,135:POKE786,199                    KB
•200 DIMB(7),D(2,2),S(7),T(4,31),T$(4),C(
9)                                            BC
•210 FORX=.TO7:B(X)=2[UPARROW]X:NEXT          EB
•220 V=53248:M=.:C=.:I=.:B=32:J=56320:S=5
4272:VB=50168:VX=10:VY=11:I$="":R=.:A=.       BA
•230 G=500:VX=10:VY=11:U=1:W=2:E=3:F=4:Q=
5:H=6:N=14:K=12:L=22:Z=21:T=.:O=129           OL
•240 VC=V+30:XS=50884:YS=50897:TC=50910:J
F=50923:CF=50930:MD=50949:SS=50993:SH=3       EH
•250 SB=51012:SF=51043:TF=51060:PL=51108:
LC=685:IRQ=50176:IQ=740:SC=.:HI=.:LS=.        CH
•260 DEFFNF(X)=(PEEK(J)AND(N+W))=.:DEFFNK
(X)=-(FNF(.)AND((PEEK(V+Z)ANDF)=.))           GF
•270 DEFFNB(X)=-(C<>L*EANDC<>O+U):DEFFNL(
X)=-((PEEK(V+Z)ANDB)=.)                       AO
•280 DEFFNX(X)=SGN(PEEK(V)-PEEK(V+A*W)):D
EFFNY(X)=SGN(PEEK(V+U)-PEEK(V+A*W+U))         DD
•290 DEFFNC(X)=-((CANDQ)>.):DEFFNCD(X)=-(
(CAND193)=U)                                  PJ
•300 DEFFNW(X)=-(C=NORC=KORC=LORC=Z-U):DE
FFNR(X)=RND(U)*(H+W)+U                        MI
•310 FORX=.TO31:READA:T(.,X)=A:T(1,X)=A:T
(2,X)=A:NEXT                                  PG
•320 FORI=3TO4:FORX=.TO31:READT(I,X):NEXT
X,I:FORX=.TO4:READT$(X),C(2*X),C(2*X+1)       BF
•330 NEXT:FORX=.TO2:FORI=.TO2:READD(X,I):
NEXTI,X:FORI=.TO7:READS(I):NEXT               DE
•340 FORX=.TO13:B$(.)=B$(.)+"#%":B$(1)=B$
(1)+"$&":NEXT                                 MH
•350 SYSXS,24,225:SYSYS,55,230:SYSCF,36,3
9,24:SYSSB,3,43,7:SYSSB,4,43,7                CM
```

```
·360 SYSSF,0:SYSSF,35:SYSTF,0                    MN
·370 SYSMD,0,0:SYSMD,1,0:SYSMD,2,1:SYSMD,
3,4:SYSMD,4,6:SYSMD,6,0:SYSMD,7,0                MH
·380 SYSSS,0,1:SYSSS,2,5:SYSSS,3,1:SYSSS,
4,1                                              HD
·390 POKEV+28,219:POKEV+37,15:POKEV+38,11
:POKEV+41,1                                      DD
·400 POKEIQ,.:FORX=.TO31:POKE61720+X,.:NE
XT:POKEIQ,1:SYSSS,5,1                            KP
·410 SYSPL,2,13:PRINT"[RVSON][RED] PRESS
FIRE BUTTON TO START MISSION "                   DK
·420 LS=.:T=.:I=.:PRINT"[GREEN]";:FORA=.T
O4:SYSPL,3+A*7,15:PRINTT$(A);:NEXT:GOSUB
990                                              CH
·430 PRINT:PRINT"[CLEAR][c 2]"B$(1):PRINT
"[UP][UP]":FORX=.TO11:PRINTB$(.):PRINTB$
(1):NEXT                                         IE
·440 PRINTB$(.)"[HOME][GREEN][DOWN]":FORX
=.TO20                                           LP
·450 PRINTCHR$(13)TAB(28)"[RVSON][s B][9"
"][s B][LEFT]";CHR$(148)" ";:NEXT                EK
·460 PRINTCHR$(13)TAB(28)"[RVSON][c Z][9"
[s C]"][c X][LEFT]";CHR$(148)"[s C]";            HN
·470 PRINT"[HOME]"TAB(28)"[c A][9"[s C]"]
[c S][LEFT]"CHR$(148)"[s C]"                     HA
·480 PRINTTAB(28)"[RVSON][s B][GREEN]VEE
KLORO[s B][LEFT]"CHR$(148)" [LEFT][GREEN
]S"                                              HF
·490 PRINTTAB(28)"[RVSON][c Q][9"[s C]"][
c W][LEFT]"CHR$(148)"[s C]":PRINTTAB(30)
"[RVSON][c A][7"[s C]"][c S]"                    PG
·500 PRINTTAB(30)"[RVSON][s B][7" "][s B]
":PRINTTAB(30)"[RVSON][c Z][7"[s C]"][c
X]":PRINTTAB(31)"[c A][5"[s C]"][c S]"           GK
·510 PRINTTAB(31)"[s B]SCORE[s B]":PRINTT
AB(31)"[s B][YELLOW][5"0"][GREEN][s B]":
PRINTTAB(31)"[c Q][5"[s C]"][c W]"               OJ
·520 PRINTTAB(31)"[s B]HIGH [s B]":PRINTT
AB(31)"[s B][WHITE][5"0"][GREEN][s B]":P
RINTTAB(31)"[c Q][5"[s C]"][c W]"                JD
·530 PRINTTAB(31)"[s B]SHIPS[s B]":PRINTT
AB(31)"[s B][CYAN][s X] [s X] [s X][GREE
N][s B]":PRINTTAB(31)"[c Q][5"[s C]"][c
W]"                                              BA
·540 PRINTTAB(31)"[s B]FLAGS[s B]":PRINTT
AB(31)"[s B][5" "][GREEN][s B]":PRINTTAB
(31)"[s B][5" "][s B]"                           OE
·550 PRINTTAB(31)"[c Q][5"[s C]"][c W]"          JO
·560 PRINTTAB(31)"[s B]MILES[s B]":PRINTT
AB(31)"[s B][5" "][GREEN][s B]":PRINTTAB
(31)"[c Z][5"[s C]"][c X]"                       HM
·570 FORX=.TO7:POKEVB+X,S(X):NEXT:GOSUB95
0                                                MD
·580 POKEV+27,-(T=.)*192:R=8+(T<W)*-16:SY
STC,6,R:POKEVB+4,50+(T>U)*N+(T>W)*-U             LP
·590 GOSUB880:M=.:POKEV+27,-(T=.)*192            OE
·600 POKEV+Z,1+2+8+16+64+128:X=PEEK(VC):X
=PEEK(VC):POKE730,230                            DM
·610 SYSIRQ:SYSJF,U                              LL
·620 REM MAIN LOOP                               GM
·630 C=PEEK(VC):SYSPL,N*W+F,Z:PRINT"[WHIT
E]"M:ONFNK(.)GOSUB50:ONFNC(.)GOTO660             EE
·640 ONFNL(.)GOSUB150:ONFNW(.)GOSUB110           ND
·650 M=M+U:ON-(M<G)GOTO630:T=T+U+(T=F)*Q:
LS=LS+U:SYSSS,Q,LS:GOTO580                       CD
·660 ONFNCD(.)GOTO670:GOTO640                    GC
·670 SYSJF,.:POKEV+Z,PEEK(V+Z)AND253:SYSS
B,.,38,F:SYSTF,U:SYSTC,H,RORU                    FF
·680 GOSUB30:SH=SH-U:SYSPL,32+SH*W,14:PRI
NT" "                                            LE
·690 ON-(SH=.)GOTO710:WAITV+Z,1,1:GOSUB96
0:POKEVB,32:POKEV+Z,219                          BO
·700 SYSSF,1:FORX=.TOE:C=PEEK(VC):NEXT:SY
SJF,U:GOTO630                                    BO
·710 WAITV+Z,U,U:POKEV+Z,248:SYSPL,9,12:P
RINT"[RVSON][WHITE] GAME OVER "                  MG
·720 GOSUB920:FORX=.TO5000:NEXT:SH=E:T=.:
SC=.:POKEV+Z,.:GOSUB740:GOTO400                  DF
·730 REM TITLE SCREEN                            LM
·740 PRINT"[CLEAR][4"[DOWN]"] [RED][c A][
36"[s C]"][c S]"                                 IF
·750 PRINT" [s B]  [YELLOW]CLEVE BLAKEMOR
E PRESENTS[3"."][7" "][RED][s B]"                HB
·760 PRINT" [GREEN][c *][RVSON] [c *][RED
][RVSOFF][s C][s C][GREEN][RVSON][sEP] [
RVSOFF][sEP][RED][8"[s C]"][GREEN][RVSON
]  [RED][RVSOFF][s C][GREEN][RVSON][sEP]
[RVSOFF][sEP][RED][16"[s C]"][c W]"              EF
·770 PRINT" [s B][UPARROW][c *]R [c *][sE
P] [s R][sEP]R[c H][c O][c O][c H][c O][
c O][s R][3" "]R[SS] [sEP][s R][sEP] R[c
 H][s R]  R[c H] [c L][c G][s R][c U]R [
s R][c J]R[c H] [c L]  [s R] [EP][s B]"          NE
·780 PRINT" [s B] [UPARROW][c *]R[SS] [s
R][sEP] R[c H][c U][s R] R[c H][c U][s R
][4" "]R[SS] [s R][c *]R[c *][s R] R[c H
][s R]  R[c H][s R] R[c L][c G][s R][c Y
][c *]R[c *][c H][s R] R[c L][s R][c *]R
[c *][s R] [EP][s B]"                            IK
·790 PRINT" [c Q][s C][s C][UPARROW][c *]
[sEP][EP][s C][s C][UPARROW]R[c H][c U][
c U][c H][c U][c U][EP][s R][3"[s C]"][U
PARROW]R  [EP][s R][s C][UPARROW][c *]R[
c *][c H]  [c H] [c L][c G][EP][s R][s C
][s C][UPARROW]R [c H] [c L]  [EP][s R][
s C][c W]"                                       BN
·800 PRINT" [s B][15" "][UPARROW]R[c O][c
 O][s R]  [c *][9" "]R [s R][6" "][EP][s
B]"                                              OE
·810 PRINT" [s B][8" "][sPI]JOYSTICK IN P
ORT TWO[8" "][EP][s B]"                          DF
·820 PRINT" [c Q][36"[s C]"][c W]"               HO
·830 PRINT" [s B]EAPPROACHING V-KLS,THE M
YSTERY PLANET[EP][s B]"                          NP
·840 PRINT" [c Q][36"[s C]"][c W]"               AK
·850 PRINT" [s B]"SPC(36)"[s B]"                 EN
```

```
·860 PRINT" [c Z][36"[s C]"][c X]":RETURN NB
·870 REM NEW TERRAIN                       OC
·880 POKEIQ,.:FORX=.TO31:POKE61720+X,T(T,
 X):NEXT:POKEIQ,1:SYSPL,31,4              OL
·890 PRINT"R[UPARROW]"T$(T):POKEV+34,C(T*
 2):POKEV+35,C(T*2+1):POKE646,C(T*2+1)+8  KD
·900 SYSPL,(32+T*2+(T>2)*-35),17:PRINT"[E
 P]":SYSPL,32,21:PRINT"[4" "]"            CF
·910 POKEV+42,12:POKEV+43,12:POKELC,12:PO
 KEV+44,12:POKEV+45,12                    MI
·920 IFSC>HITHENHI=SC                     JB
·930 I$=STR$(HI):SYSPL,32,11:PRINT"[s R]E
 ";:GOSUB180:RETURN                       DP
·940 REM RESET POSITIONS                  IO
·950 POKEV+12,220:POKEV+14,125:POKEV+13,.
 :POKEV+15,130                            AJ
·960 POKEV,125:POKEV+1,215:POKEV+2,PEEK(V
 ):POKEV+3,PEEK(V+1)-90                   ON
·970 POKEV+6,75:POKEV+7,.:POKEV+8,200:POK
 EV+9,.:RETURN                            BM
·980 REM COMPUTERESE - SELECT TERRAIN     FM
·990 POKES+11,64:POKE S+24,15:POKES+U,25:
 POKES+Q,16:POKES+H,240:POKES+F,17        NN
·1000 POKES+U,N*RND(.):I=T                NC
·1010 IFUSR(.)=3THENT=T+1+(T=4)*5         FL
·1020 IFUSR(.)=7THENT=T-1+(T=.)*-5        DJ
·1030 SYSPL,3+T*7,15:PRINT"R[UPARROW]"T$(
 T):IFT<>ITHENSYSPL,3+I*7,15:PRINT"[s R][
 UPARROW]"T$(I)                           KJ
·1040 IFFNF(.)=.THEN1000                  ED
·1050 SYS52545:POKES+H,242:POKES+W,10:POK
 ES+E,O:RETURN                            EG
·1060 REM COPY CHAR SET                   ON
·1070 POKE56333,127:POKE1,51              GI
·1080 POKE781,9:POKE782,1:POKE90,.:POKE91
 ,216:POKE88,.:POKE89,248:SYS41964        EF
·1090 POKE1,55:POKE56333,129              DI
·1100 READA:IFA=-1THENRETURN              ON
·1110 FORX=.TO7:READD:POKE61440+A*8+X,D:N
 EXT:GOTO1100                             HO
·1120 POKE56578,PEEK(56578)OR3:POKE56576,
 PEEK(56576)AND252                        MN
·1130 POKE53272,PEEK(53272)AND15:POKE648,
 192:PRINTCHR$(147)                       OI
·1140 POKE53272,(PEEK(53272)AND240)OR12   EG
·1150 POKE53270,PEEK(53270)OR16:PRINTCHR$
 (147):RETURN                             OB
·1160 DATA28,128,112,127,124,112,64,64,64 CA
·1170 DATA48,126,66,66,66,66,66,126,.     LC
·1180 DATA49,8,24,8,8,8,8,28,.            DE
·1190 DATA50,126,66,4,8,16,32,126,.       FG
·1200 DATA51,126,2,2,14,2,2,126,.         LF
·1210 DATA52,4,12,20,36,126,4,4,.         NA
·1220 DATA53,126,64,64,126,2,2,126,.      MH
·1230 DATA54,126,64,64,126,66,66,126,.    AL
·1240 DATA55,126,2,2,2,2,2,2,.            FG
·1250 DATA56,126,66,66,126,66,66,126,.    EJ
·1260 DATA57,126,66,66,126,2,2,2,.        NL
·1270 DATA88,,24,24,219,255,219,219,.,-1  IM
·1280 DATA186,102,153,170,170,157,102,234 JP
·1290 DATA171,102,153,170,170,153,102,186 KH
·1300 DATA170,102,153,170,174,153,102,170 IB
·1310 DATA170,102,153,174,170,153,118,170 CA
·1320 DATA170,42,202,242,252,252,252,252  DH
·1330 DATA252,252,252,252,241,197,21,.    DP
·1340 DATA170,168,161,133,21,21,21,21     JL
·1350 DATA21,21,21,21,69,81,84,.          AN
·1360 DATA3,3,10,46,46,186,186,170        IP
·1370 DATA170,170,170,42,42,10,3,3        JP
·1380 DATA192,192,80,84,148,149,165,165   KL
·1390 DATA165,165,165,148,84,80,192,192   PB
·1400 REM TERRAIN TYPES                   LO
·1410 DATA OCEANS,14,6,DESERT,10,9,JUNGLE
 ,7,5,CITY 1,11,15,CITY 2,11,9            GK
·1420 REM FIRE DIRECTION ARRAY            GL
·1430 DATA 8,1,2,7,,3,6,5,4               EM
·1440 REM SPRITE POINTERS                 HK
·1450 DATA 32,52,33,50,36,33,34,35        PC
```

KLOROS.OBJ

Starting address in hex: C400
Ending address in hex: CDE0

Flankspeed **required for entry! See page 75.**

```
C400: 78 A9 3F 8D 14 03 A9 C4 74
C408: 8D 15 03 AD DA 02 8D 12 D7
C410: D0 AD 11 D0 29 7F 8D 11 B7
C418: D0 A9 81 8D 1A D0 A9 87 BD
C420: 8D 11 03 A9 C7 8D 12 03 D5
C428: AD E9 C7 8D A9 02 8D AA F8
C430: 02 EA EA 58 A9 81 8D 12 2B
C438: D4 A9 FF 8D 0F D4 60 AD 36
C440: 19 D0 8D 19 D0 29 01 D0 9C
C448: 07 AD 0D DC 58 4C 31 EA A7
C450: CE A9 02 D0 51 AD E9 C7 4C
C458: 8D A9 02 A2 07 BD B2 C7 73
C460: 2D EB C7 F0 3E BD BF 02 EF
C468: 18 7D D0 02 9D F8 C3 DE 0A
C470: D0 02 10 2F BD DC 02 9D BC
C478: D0 02 BD B2 C7 2D AF 02 62
C480: F0 21 BD B2 C7 49 FF 2D 41
C488: 15 D0 8D 15 D0 BD B2 C7 1A
C490: 49 FF 2D AF 02 8D AF 02 F7
C498: BD B2 C7 49 FF 2D EB C7 FA
C4A0: 8D EB C7 CA 10 B7 AD EC 0F
C4A8: C7 D0 03 4C D7 C4 AD 00 DA
C4B0: DC 29 0F 85 FD A9 0F 38 3A
C4B8: E5 FD A8 B9 DE C7 F0 17 AD
```

```
C4C0: 8D A8 02 A0 00 20 ED C4 6C
C4C8: AD 00 D0 8D 02 D0 AD 01 56
C4D0: D0 38 E9 5A 8D 03 D0 A9 29
C4D8: 07 8D A7 02 AC A7 02 B9 27
C4E0: B0 02 F0 06 8D A8 02 20 E2
C4E8: ED C4 4C 63 C5 B9 B2 C7 45
C4F0: 2D F3 C7 D0 10 AD A8 02 13
C4F8: 0A AA BD BA C7 08 98 0A 98
C500: AA 28 4C 0B C5 98 0A AA 3D
C508: BD CC C7 30 0F F0 17 B9 5B
C510: C8 02 18 7D 00 D0 9D 00 DE
C518: D0 4C 26 C5 BD 00 D0 38 E7
C520: F9 C8 02 9D 00 D0 B9 B2 BF
C528: C7 2D F3 C7 D0 12 AD A8 12
C530: 02 0A AA E8 BD BA C7 08 18
C538: 98 0A AA E8 28 4C 47 C5 EF
C540: 98 0A AA E8 BD CC C7 30 F8
C548: 0F F0 17 B9 C8 02 18 7D 79
C550: 00 D0 9D 00 D0 4C 62 C5 04
C558: BD 00 D0 38 F9 C8 02 9D 81
C560: 00 D0 60 CE A7 02 30 03 3D
C568: 4C DC C4 A2 07 8E A7 02 38
C570: AC A7 02 98 0A AA BD 00 D1
C578: D0 38 CD EF C7 B0 09 AD 6E
C580: EF C7 9D 00 D0 4C 97 C5 50
C588: BD 00 D0 38 CD F0 C7 90 66
C590: 26 AD F0 C7 9D 00 D0 B9 45
C598: B2 C7 2D EE C7 F0 0C A9 9D
C5A0: FF 38 F9 B2 C7 2D 15 D0 60
C5A8: 8D 15 D0 BD CC C7 F0 07 66
C5B0: 49 FF 09 01 9D CC C7 B9 EF
C5B8: B2 C7 2D ED C7 F0 42 E8 32
C5C0: BD 00 D0 38 CD F1 C7 B0 BF
C5C8: 09 AD F1 C7 9D 00 D0 4C F3
C5D0: E1 C5 BD 00 D0 38 CD F2 FF
C5D8: C7 90 26 AD F2 C7 9D 00 5D
C5E0: D0 B9 B2 C7 2D EE C7 F0 BA
C5E8: 0C A9 FF 38 F9 B2 C7 2D 78
C5F0: 15 D0 8D 15 D0 BD CC C7 9C
C5F8: F0 07 49 FF 09 01 9D CC AE
C600: C7 CE A7 02 30 03 4C 70 30
C608: C5 AD E4 02 F0 05 CE DB 03
C610: 02 F0 03 4C B8 C6 A9 02 7D
C618: 8D DB 02 CE AA 02 10 05 14
C620: A9 09 8D AA 02 AE AA 02 68
C628: A0 07 B9 B2 C7 2D F4 C7 ED
C630: F0 06 BD F5 C7 99 27 D0 34
C638: 88 10 EF A5 01 29 FD 85 14
C640: 01 AD 27 F1 8D AB 02 AD F0
C648: 37 F1 8D AC 02 A2 0F A0 FF
C650: 0F CA BD 18 F1 99 18 F1 95
C658: BD 28 F1 99 28 F1 88 D0 3D
C660: F0 AD AB 02 8D 18 F1 AD F1
C668: AC 02 8D 28 F1 A5 01 09 6E
C670: 02 85 01 A2 00 EE 0D D0 68
C678: D0 02 A2 06 EE 0F D0 D0 93
C680: 02 A2 07 8A F0 32 A8 0A 8C
C688: AA AD AD 02 99 27 D0 AD CF
C690: 1B D4 29 01 18 69 22 99 E7
C698: F8 C3 AD 1B D4 38 CD EF E8
C6A0: C7 90 15 38 CD F0 C7 B0 7D
C6A8: 03 9D 00 D0 A9 FF 38 F9 F5
C6B0: B2 C7 2D F4 C7 8D F4 C7 5F
C6B8: 20 68 CD AD DA 02 8D 12 39
C6C0: D0 4C BC FE 20 9B B7 8E 9B
C6C8: EF C7 20 9B B7 8E F0 C7 3B
C6D0: 60 20 9B B7 8E F1 C7 20 0D
C6D8: 9B B7 8E F2 C7 60 20 9B 91
C6E0: B7 8E E9 C7 20 9B B7 8E DA
C6E8: EB C7 60 20 9B B7 8E EC EB
C6F0: C7 60 20 9B B7 8E EE C7 D1
C6F8: 20 9B B7 8E ED C7 20 9B 6C
C700: B7 8E F3 C7 60 20 9B B7 D5
C708: 8A 29 07 48 20 9B B7 68 E6
C710: A8 38 E0 09 90 02 A2 00 10
C718: 8A 99 B0 02 98 0A A8 8A C4
C720: 0A AA BD BA C7 99 CC C7 43
C728: C8 E8 BD BA C7 99 CC C7 48
C730: 60 20 9B B7 8A 29 07 48 07
C738: 20 9B B7 68 A8 8A 29 0F 7F
C740: 99 C8 02 60 20 9B B7 8A 03
C748: 29 07 48 20 9B B7 68 A8 45
C750: 8A 99 BF 02 98 48 20 9B D2
C758: B7 68 A8 8A 99 DC 02 99 BD
C760: D0 02 60 20 9B B7 8A D0 62
C768: 04 8D F4 C7 60 0D F4 C7 E0
C770: 8D F4 C7 60 20 9B B7 8A 19
C778: D0 06 A9 00 8D AF 02 60 98
C780: 0D AF 02 8D AF 02 60 20 FE
C788: AA B1 98 29 01 AA BD 00 10
C790: DC 29 0F 85 FD A9 0F 38 1A
C798: E5 FD A8 B9 DE C7 A8 A9 D7
C7A0: 00 6C 05 00 20 9B B7 8A 10
C7A8: 48 20 9B B7 68 A8 18 4C D9
C7B0: F0 FF 01 02 04 08 10 20 E0
C7B8: 40 80 00 00 00 FF 01 FF 7A
C7C0: 01 00 01 01 00 01 FF 01 C5
C7C8: FF 00 FF FF 00 00 00 00 C8
C7D0: 00 00 00 00 00 00 00 00 D0
C7D8: 00 00 00 00 00 00 00 01 D9
C7E0: 05 00 07 08 06 00 03 02 FF
C7E8: 04 08 01 00 01 01 00 18 10
C7F0: FA 55 E6 E0 00 09 02 0A 1E
C7F8: 07 01 07 0A 02 09 00 00 1D
C800: 00 00 00 00 00 00 00 00 00
C808: 00 00 00 00 00 00 00 00 08
C810: 5F 00 01 57 C0 01 6B C0 B5
C818: 01 6B C0 01 57 C0 00 5F BD
C820: 00 54 5F 17 64 5F 1B 55 1F
C828: 5F 57 55 5F 57 55 5F 57 F6
C830: 55 5F 57 64 1C 1B 54 28 54
C838: 17 54 00 17 A0 00 0A FF 65
C840: 00 00 00 00 00 00 00 00 40
C848: 00 00 00 00 00 00 00 00 48
C850: 00 00 00 00 00 00 00 00 50
C858: 00 18 00 00 3C 00 00 3C E8
```

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C860: 00 00 18 00 00 00 00 00 78
C868: 00 00 00 00 00 00 00 00 68
C870: 00 00 00 00 00 00 00 00 70
C878: 00 00 00 00 00 00 00 FF 78
C880: 00 00 00 00 00 00 00 AB 2C
C888: C0 02 5A F0 09 5A FC 05 FB
C890: 5A BC 25 6A BF 25 AA BF 86
C898: 26 AA BF 2A AA BF 2A AA 92
C8A0: BF 2A AA BF 2A AA BF 2A B3
C8A8: AA BF 2A AA BF 0A AA BC 19
C8B0: 0A AA FC 02 AA F0 00 AB AB
C8B8: C0 00 00 00 00 00 00 00 79
C8C0: 00 1B 00 00 5A C0 00 6A 61
C8C8: C0 00 AA C0 00 AA C0 00 60
C8D0: 2B 00 00 2B 00 1C 2F 18 8A
C8D8: 6B 9B 5B 6B AB AB AB AB 55
C8E0: EB 2C 2F 2C 00 2B 00 00 7F
C8E8: 1B 00 00 5A C0 00 6A C0 4A
C8F0: 00 AA C0 00 AA C0 00 2B F2
C8F8: 00 00 00 00 00 00 00 00 F8
C900: 00 00 00 00 00 00 00 00 00
C908: 00 0B 00 F0 07 00 F0 0A 06
C910: AB F0 06 BF F0 0A EB F0 4A
C918: A6 5A FF 6A 6A FF A6 AA 3F
C920: FF 6A AA FF A6 AA FF 0A 90
C928: EB F0 06 BF F0 0A AB F0 62
C930: 0B 00 F0 0B 00 F0 00 00 28
C938: 00 00 00 00 00 00 00 FF 38
C940: 01 FF C0 06 FF F0 1A BE D1
C948: FC 6A FF BF AA 7F BF A9 03
C950: EB FF A7 FF FF 9F FF FF 83
C958: BF BE FF BF AA FF BE D7 D7
C960: BF BF AA FF BF BE FF 9F A8
C968: FF FF A7 FF FF A9 EB FF A5
C970: AA 7F BF 6A FF BF 1A BE 5D
C978: FC 06 FF F0 01 FF C0 01 2F
C980: 20 20 20 08 82 80 8A AA 21
C988: 8A 2A AA A8 AA AA A0 2A B0
C990: AA AA AA AA AA 2A AA A8 63
C998: 0A AA A0 AA AA A8 2A AA C0
C9A0: AA 2A AA AA 0A AA A2 2A 4C
C9A8: AA A8 AA AA AA 0A AA A2 53
C9B0: 2A AA A8 AA AA A8 2A 2A 80
C9B8: 8A 28 88 82 80 08 22 00 21
C9C0: 00 00 00 00 02 00 08 22 EC
C9C8: 00 02 0A 08 2A AA A0 0A 5C
C9D0: AA 88 8A AA A2 2A AA A8 59
C9D8: 0A AA A0 2A AA A8 2A AA 80
C9E0: A8 0A AA AA 0A AA A0 2A 68
C9E8: AA A8 2A AA A0 0A AA A0 07
C9F0: 20 A8 A0 02 A2 20 02 00 21
C9F8: 08 00 00 00 00 00 00 00 01
CA00: 00 00 00 00 00 00 00 00 00
CA08: 00 02 08 00 08 88 20 02 C4
CA10: AA 80 02 AA 80 2A AA 88 C5
CA18: 02 AA A0 0A AA 80 2A AA 6F
CA20: A8 02 AA 80 0A AA A0 22 6D
CA28: AA 00 02 AA 80 08 AA 00 B2
CA30: 00 A0 80 02 20 00 00 00 73
CA38: 00 00 00 00 00 00 00 00 38
CA40: 00 00 00 00 00 00 00 00 40
CA48: 00 00 00 00 00 00 00 02 4A
CA50: 08 80 00 AA 00 08 AA 80 B6
CA58: 02 AA 00 02 AA 80 0A AA E6
CA60: 00 02 AA 80 0A A8 00 00 40
CA68: A2 00 02 20 00 00 00 00 2D
CA70: 00 00 00 00 00 00 00 00 70
CA78: 00 00 00 00 00 00 00 00 78
CA80: 00 00 00 00 00 00 00 00 80
CA88: 00 00 00 00 00 00 00 00 88
CA90: 00 00 00 82 00 00 28 00 3B
CA98: 02 AA 00 00 AA 80 02 AA 1D
CAA0: 00 00 2A 00 00 88 80 00 D3
CAA8: 00 00 00 00 00 00 00 00 A8
CAB0: 00 00 00 00 00 00 00 00 B0
CAB8: 00 00 00 00 00 00 00 00 B8
CAC0: 00 00 00 00 00 00 00 04 C4
CAC8: 00 00 04 00 00 15 00 00 E1
CAD0: 19 00 00 13 00 00 23 00 20
CAD8: 00 23 00 00 23 00 00 23 42
CAE0: 00 00 23 00 00 23 00 00 27
CAE8: 23 00 00 23 00 00 2B 00 5A
CAF0: 00 2F 00 00 0C 00 00 0C 38
CAF8: 00 00 00 00 00 00 00 C3 BC
CB00: 00 00 00 00 00 00 00 2F 2F
CB08: 00 00 AB C0 00 A3 C0 00 D8
CB10: 40 C0 00 40 C0 01 40 F0 44
CB18: 01 80 F0 01 80 F0 01 80 7E
CB20: F0 01 80 F0 02 80 F0 02 F8
CB28: 80 F0 00 80 C0 00 80 C0 1C
CB30: 00 A3 C0 00 AB C0 00 2F 30
CB38: 00 00 00 00 00 00 00 22 5A
CB40: 00 00 00 00 00 00 00 2B 6B
CB48: 00 00 AB C0 02 80 F0 02 2A
CB50: 80 F0 02 00 30 0A 00 3C 3A
CB58: 06 00 3C 06 00 3C 06 00 E2
CB60: 3C 06 00 3C 06 00 3C 06 27
CB68: 00 3C 01 00 30 01 80 F0 48
CB70: 02 80 F0 00 AB C0 00 2F 7F
CB78: 00 00 00 00 00 00 00 43 BB
CB80: 00 00 00 00 00 00 00 AF 30
CB88: C0 02 AA F0 0A 00 3C 0A 37
CB90: 00 3C 28 00 0F 28 00 0F 3B
CB98: 28 00 0F 20 00 03 20 00 13
CBA0: 03 20 00 03 28 00 0F 28 26
CBA8: 00 0F 14 00 0F 05 00 3C 1C
CBB0: 05 00 3C 01 5A F0 00 5F 9D
CBB8: C0 00 00 00 00 00 00 32 AB
CBC0: 00 00 00 00 00 00 00 2B EB
CBC8: 00 00 AB C0 02 80 F0 02 AA
CBD0: 80 F0 02 00 30 0A 00 3C BA
CBD8: 0A 00 3C 0A 00 3C 0A 00 6F
CBE0: 3C 0A 00 3C 0A 00 3C 0A B3
CBE8: 00 3C 02 00 30 02 80 F0 CA
CBF0: 01 40 F0 00 55 40 00 15 CD
CBF8: 00 00 00 00 00 00 00 43 3C
```

```
CC00: 00 00 00 00 00 00 00 2F 2F
CC08: 00 00 AB C0 00 A3 C0 00 D8
CC10: 80 C0 00 80 C0 02 80 F0 06
CC18: 02 80 F0 02 80 F0 02 80 81
CC20: F0 02 80 F0 02 80 70 02 79
CC28: 80 70 00 80 40 00 80 40 9A
CC30: 00 A1 40 00 A9 C0 00 2D A9
CC38: 00 00 00 00 00 00 00 22 5A
CC40: 00 00 00 00 00 00 00 0C 4C
CC48: 00 00 0C 00 00 2B 00 00 7F
CC50: 25 00 00 21 00 00 21 00 B7
CC58: 00 21 00 00 21 00 00 21 BB
CC60: 00 00 22 00 00 22 00 00 A4
CC68: 22 00 00 22 00 00 2B 00 D7
CC70: 00 2F 00 00 0C 00 00 0C B7
CC78: 00 00 00 00 00 00 00 C3 3C
CC80: 00 00 00 00 00 00 00 0B 8B
CC88: 00 00 07 00 00 07 00 00 96
CC90: 07 00 00 07 00 00 07 00 A5
CC98: 00 07 00 00 07 00 00 0B B1
CCA0: 00 00 0B 00 00 0B 00 00 B6
CCA8: 0B 00 00 0B 00 00 0B 00 C9
CCB0: 00 0B 00 00 0B 00 00 0B D1
CCB8: 00 00 00 00 00 00 00 C3 7C
CCC0: 00 00 00 00 00 00 00 00 C0
CCC8: 00 00 00 00 00 CC C0 0C 62
CCD0: F5 30 03 FD 40 33 EF 40 9B
CCD8: 0E FF 5C 0F BE D0 0F FF F0
CCE0: D0 3E FF D0 0F EE D0 0E 9D
CCE8: FF 5C 33 FB 40 03 BD 40 B5
CCF0: 0C F5 30 03 03 00 00 00 29
CCF8: 00 00 00 00 00 00 00 00 F8
CD00: 00 00 00 00 00 00 00 00 00
CD08: 00 0F C3 F0 0C 00 30 0C 14
CD10: 00 30 0C 00 30 0C 00 30 B8
CD18: 0C 00 30 00 28 00 00 28 A4
CD20: 00 00 28 00 0C 00 30 0C 90
CD28: 00 30 0C 00 30 0C 00 30 D0
CD30: 0C 00 30 0F C3 F0 00 00 30
CD38: 00 00 00 00 00 00 00 00 38
CD40: 00 A2 18 A9 00 9D 00 D4 17
CD48: CA 10 FA A9 0F 8D 18 D4 51
CD50: A9 00 8D E6 02 A9 F0 8D 98
CD58: 0D D4 A9 11 8D 0B D4 A9 0C
CD60: 19 8D 09 D4 8D 0A D4 60 B1
CD68: A9 A0 85 FA A9 CD 85 FB 2C
CD70: CE E5 02 D0 21 A9 0A 8D 5A
CD78: E5 02 AC E6 02 38 C0 40 2F
CD80: 90 05 A0 00 8C E6 02 B1 DD
CD88: FA 8D 08 D4 C8 B1 FA 8D F0
CD90: 07 D4 C8 8C E6 02 AD E5 3E
CD98: 02 18 69 64 8D 09 D4 60 4C
CDA0: 1C 31 90 00 12 D1 00 00 D1
CDA8: 19 1E 00 00 19 1E 00 00 17
CDB0: 1C 31 00 00 12 D1 00 00 E1
CDB8: 19 1E 00 00 19 1E 00 00 27
CDC0: 1C 31 00 00 15 1F 00 00 42
CDC8: 19 1E 00 00 19 1E 00 00 37
CDD0: 1C 31 00 00 15 1F 00 00 52
CDD8: 19 1E 00 00 19 1E 00 FF 47
CDE0: 00 E0
```

3-D GRAPHIC PROJECTOR
FROM PAGE 41

3-D BOOTER

```
·10 IFA=0THENA=1:LOAD"LINES",8,1                      LG
·20 PRINT"[CLEAR][DOWN][DOWN]L[s O]"CHR$(
 34)"3-D"CHR$(34)",8                                   PP
·30 PRINT"[4"[DOWN]"]RUN":PRINT"[HOME]";:
POKE198,2:POKE631,13:POKE632,13:END                    EJ
```

3-D

```
·10 DIMXE(300),YE(300),C%(300)                         OK
·12 FORT=54272TO54296:POKET,.:NEXT                     GC
·15 POKE54296,2:POKE54277,8:POKE54278,240              DA
·17 POKE54276,33                                       DO
·20 SYS50448:U=50630:Q=1:W=2                           MF
·40 POKE53280,14:POKE53281,14:POKE646,6                NE
·50 PRINT"[CLEAR][6"[DOWN]"][CTRL N][5" "
 ][s W][s E][s L][s C][s O][s M][s E] [s
 T][s O][DOWN][DOWN]"                                  KO
·60 PRINT"[BLACK][14" "]3-[s D]                        JE
·70 PRINT"[16" "][s G]RAPHIC"                          IL
·75 PRINT"[19" "][s P]ROJECTOR"                        OL
·77 PRINT"[DOWN][DOWN][BLUE][21" "][s B]Y
 : [s E]RIC [s F]ORTIER"                               HP
·78 PRINT"[21" "]ON: [s O]CT 26 1987"                  MC
·79 PRINT"[4"[DOWN]"][11" "][s H]IT A KEY
  TO START."                                           LC
·80 V$="[20"[RIGHT]"]"                                 NM
·90 POKE198,0:WAIT198,1                                KM
·100 POKE198,0:BA=16384:INPUT"[CLEAR][4"[
 DOWN]"][s L]OCATION FOR DATA:";BA:NM=BA               MF
·110 PRINT"[CLEAR][RVSON][40" "]";                     FD
·120 PRINT"[RVSON][15" "][s M]AIN [s M]EN
 U[16" "]";                                            HE
·130 PRINT"[RVSON][40" "]"                             BI
·140 PRINT"[DOWN][CTRL N][s C]HOOSE:"                  CI
·150 PRINT"[DOWN][3" "]1. [s M]AKE A NEW
 PICTURE"                                              LP
·160 PRINT"[3" "]2. [s E]DIT PICTURE IN M
 EMORY"                                                KA
·170 PRINT"[3" "]3. [s V]IEW PICTURE IN M
 EMORY"                                                PO
·180 PRINT"[3" "]4. [s L]OAD A PICTURE"                KB
·190 PRINT"[3" "]5. [s S]AVE A PICTURE"                KP
·200 PRINT"[3" "]6. [s Q]UIT":PRINT"[DOWN
 ][BLACK][s Y]OUR CHOICE:[BLUE]";                      DC
```

```
·210 GETC$:IFC$=""THEN210                           AA
·220 IFC$<"1"ORC$>"6"THEN210                        HE
·230 ONVAL(C$)GOSUB690,1130,250,580,1820,
 570                                                KP
·240 GOTO110                                        AM
·250 PRINT" [s V]IEW A PICTURE.":FORT=1TO
 400:NEXT                                           PB
·260 PRINT"[CLEAR][CTRL N][DOWN][DOWN]"             JK
·270 PRINT"[s P]RESS: <[s C][s R]> FOR [s
 P]ROJECTION"                                       OE
·280 PRINT"[7" "]<[s M]>  FOR [s M]AIN [s
 M]ENU.":PRINT"[DOWN][s Y]OUR [s C]HOICE
 :";                                                HM
·290 GETA$:IFA$=""THEN290                           IB
·300 IFA$="M"THENPRINT" [s M]AIN [s M]ENU
 .":FORT=1TO300:NEXT:RETURN                         DK
·310 IFA$=CHR$(13)THENPRINT" [s P]ROJECTI
 ON.":FORT=1TO400:NEXT:GOTO330                      LL
·320 GOTO290                                        GA
·330 PRINT"[CLEAR][RVSON][40" "]";                  ME
·331 PRINT"[RVSON][15" "][s P]ROJECTION[1
 5" "]";                                            LL
·332 PRINT"[RVSON][40" "]"                          NB
·339 E=0:INPUT"[3"[DOWN]"][s I]NPUT [s X]
 EXTENTION:";E:E=E+180                              OA
·340 F=0:INPUT"[s I]NPUT [s Y] EXTENTION:
 ";F:F=F+180                                        AI
·350 TX=160                                         FM
·360 TY=100                                         FP
·370 RH=180:INPUT "[s I]NPUT [s R][s H][s
 O] VALUE:";RH                                      KI
·380 TH=0:INPUT "[s I]NPUT [s T][s H][s E
 ][s T][s A] IN DEGREES:";TH:TH=-TH                 CC
·390 PH=0:INPUT "[s I]NPUT [s P][s H][s I
 ] IN DEGREES:";PH:PH=-PH                           AM
·400 PRINT"[DOWN][s S]CALING PICTURE, [s
 P]LEASE STAND BY.":FORT=1TO700:NEXT:POKE
 53265,11                                           JG
·405 POKE54272,30                                   MG
·410 K0=.0174532925:TH=TH*K0:PH=PH*K0:CY=
 199                                                EK
·420 S1=SIN(TH):C1=COS(TH):S2=SIN(PH):C2=
 COS(PH)                                            BO
·430 S3=C1*S2:S4=S1*S2:S5=C1*C2:S6=S1*C2            GA
·440 W1=1E20:W3=W1                                  KN
·450 BA=NM:O=0                                      PK
·460 Y=PEEK(BA+Q):IFPEEK(BA)THENY=-Y                HC
·470 Z=PEEK(BA+3):IFPEEK(BA+2)THENZ=-Z              KM
·480 X=PEEK(BA+5):IFPEEK(BA+4)THENX=-X              HM
·490 C%(O)=PEEK(BA+6):BA=BA+7                       OO
·500 XO=-X*S1+Y*C1:YO=-X*S3-Y*S4+Z*C2:ZO=
 -X*S5-Y*S6+RH                                      EM
·510 XE(O)=E*XO/ZO+TX:YE(O)=TY-F*YO/ZO              JE
·520 O=O+Q:IFPEEK(BA)<WTHEN460                      PD
·525 POKE54272,0                                    AH
·530 O=O-Q:POKE53280,0:SYS50977:FORT=0TOO
 :IFC%(T)=QTHENSYSU,X1,Y1,XE(T),YE(T)               BE
·540 X1=XE(T):Y1=YE(T):NEXT                         GB
·550 GETA$:IFA$=""THEN550                           KF
·560 SYS50448:POKE53280,14:GOTO260                  GE
·570 POKE49999,0:SYS49999                           DA
·580 PRINT" [s L]OAD A FILE.":FORT=1TO400
 :NEXT                                              EH
·590 PRINT"[CLEAR][CTRL N][RVSON][40" "]"
 ;                                                  AM
·600 PRINT"[14" "][s L]OAD A FILE[15" "]"
 ;                                                  PE
·610 PRINT"[40" "]":BA=NM                           JB
·620 INPUT "[DOWN][s D]ESIRED FILE:";N$             KM
·622 IFN$=""THENRETURN                              KJ
·623 OPEN15,8,0,N$+".3D,S,R"                        HP
·625 PRINT"[DOWN][s L]OADING[3"."]"                 HF
·640 GET#15,A$,B$,C$:A=ASC(A$+CHR$(0)):B=
 ASC(B$+CHR$(0)):C=ASC(C$+CHR$(0))                  JI
·650 POKEBA,A:BA=BA+1:POKEBA,B:BA=BA+1:PO
 KEBA,C:BA=BA+1:IFST=0THEN640                       PJ
·660 CLOSE15:POKE54272,0:PRINT"[DOWN][s F
 ]ILE [s L]OADED."                                  DC
·670 FORT=1TO700:GETA$:IFA$=""THENNEXT              BM
·680 RETURN                                         DI
·690 PRINT" [s M]AKE A PICTURE.":FORT=1TO
 400:NEXT                                           GO
·700 PRINT"[CLEAR][CTRL N][RVSON][40" "]"
 ;                                                  IK
·710 PRINT"[RVSON][11" "][s M]AKE A NEW P
 ICTURE[11" "]";                                    HN
·720 PRINT"[RVSON][40" "]"                          CI
·730 PRINT"[DOWN][s P]RESS:  <[s M]> TO M
 AKE A NEW PICTURE,"                                CG
·740 PRINT"[8" "]<[s R]> TO RETURN TO MEN
 U."                                                PE
·750 PRINT"[DOWN][s C]HOICE:";                      LL
·760 GETA$:IFA$=""THEN760                           GA
·770 IFA$="R"THENPRINT" [s R]ETURN TO MEN
 U.":FORT=1TO400:NEXT:GOTO110                       NN
·780 IFA$<>"M"THEN760                               FB
·790 PRINT" [s M]AKE A PICTURE!":FORT=1TO
 400:NEXT:O=0                                       NL
·800 BA=NM+(O-1)*7                                  PO
·810 PRINT"[CLEAR][4"[DOWN]"][s L]AST DAT
 A:";:IFO=0THENPRINT" [RVSON][s N]ONE.":P
 RINT:GOTO950                                       II
·820 PRINT" [s S]ET #"O                             CA
·830 X=PEEK(BA+1)                                   LM
·840 IFPEEK(BA)=1THENX=-X                           OL
·850 BA=BA+2                                        OE
·860 Y=PEEK(BA+1):IFPEEK(BA)=1THENY=-Y              GI
·870 BA=BA+2                                        AI
·880 Z=PEEK(BA+1):IFPEEK(BA)=1THENZ=-Z              BH
·890 BA=BA+2                                        AM
·900 C=PEEK(BA):BA=BA+1                             OO
·910 PRINT:PRINT"[DOWN]  [s X]="X                   OE
·920 PRINT"  [s Y]="Y                               DC
·930 PRINT"  [s Z]="Z                               EA
·940 PRINT"  [s C]="C                               AK
·950 PRINT"[DOWN][DOWN][s S]ET #"O+1                HD
```

```
•960 X=999:INPUT"[s E]NTER [s D]ATA ([s X
],[s Y],[s Z],[s C])";X,Y,Z,C:IFX=999THE
NBA=NM+O*7:GOTO1070                        MC
•970 BA=NM+O*7                             GP
•980 IFX<0THENPOKEBA,1:POKEBA+1,-X:GOTO10
00                                         AN
•990 POKEBA,.:POKEBA+1,X                   PE
•1000 BA=BA+2                              HC
•1010 IFY<0THENPOKEBA,1:POKEBA+1,-Y:GOTO1
030                                        EC
•1020 POKEBA,.:POKEBA+1,Y                  CF
•1030 BA=BA+2                              JP
•1040 IFZ<0THENPOKEBA,1:POKEBA+1,-Z:GOTO1
060                                        HE
•1050 POKEBA,.:POKEBA+1,Z                  DL
•1060 BA=BA+2:POKEBA,C:O=O+1:GOTO800       KA
•1070 IFO=0THENPRINT"[DOWN][DOWN][s N]O P
ICTURE CONSTRUCTED.":FORT=1TO300:NEXT:RE
TURN                                       ME
•1080 POKEBA,255:POKEBA+1,255              DL
•1090 PRINT"[DOWN][DOWN][s P]ICTURE [s F]
INISHED: "O" SETS OF DATA."                BF
•1100 FORT=1TO1000:GETA$:IFA$=""THENNEXT   AM
•1110 RETURN                               OI
•1120 END                                  OE
•1130 PRINT" [s E]DIT A PICTURE.":FORT=1T
O400:NEXT                                  MC
•1140 PRINT"[CLEAR][RVSON][40" "]";        EN
•1150 PRINT"[8" "][RVSON][s E]DIT A CURRE
NT PICTURE[10" "]";                        BC
•1160 PRINT"[40" "]"                       OG
•1170 PRINT:PRINT"[s D]O YOU WANT THE [s
D]ATA [s L]IST? ([s Y]/[s N]) ";           OD
•1180 GETA$:IFA$=""THEN1180                BE
•1190 IFA$="N"THENPRINT"[s N]O.":FORT=1TO
200:NEXT:GOTO1370                          JA
•1200 IFA$<>"Y"THEN1180                    BE
•1210 PRINT"[s Y]ES.":FORT=1TO400:GETA$:I
FA$=""THENNEXT                             AL
•1220 BA=NM:O=1:PRINT"[CLEAR]";:U$=""      IM
•1230 X=PEEK(BA+1):IFPEEK(BA)=255ANDPEEK(
BA+1)=255THEN1360                          BB
•1240 IFPEEK(BA)=1THENX=-X                 JI
•1250 BA=BA+2:X$=RIGHT$("  "+STR$(X),3)    DK
•1260 Y=PEEK(BA+1):IFPEEK(BA)=1THENY=-Y    BD
•1270 BA=BA+2:Y$=RIGHT$("  "+STR$(Y),3)    LE
•1280 Z=PEEK(BA+1):IFPEEK(BA)=1THENZ=-Z    LJ
•1290 BA=BA+2:Z$=RIGHT$("  "+STR$(Z),3)    MP
•1300 C=PEEK(BA):BA=BA+1:O$=RIGHT$("  "+S
TR$(O),3):SC=SC+1                          IO
•1310 GETA$:IFA$="S"THEN1360               AE
•1320 IFSC=24THENU$=V$:PRINT"[HOME]";      PP
•1330 IFSC=47THENU$="":PRINT"[HOME]"V$"[5
"[LEFT]"][RVSON][s H][s I][s T] [s A] [s
 K][s E][s Y]":POKE198,0:WAIT198,1:PRINT
"[CLEAR]";                                 NB
•1340 IFSC=47THENSC=1                      LK
•1350 PRINT:PRINTU$O$")";X$","Y$","Z$","C
;:O=O+1:GOTO1230                           HP
•1360 PRINT"[HOME][RVSON][15" "][s H][s I
][s T] [s A] [s K][s E][s Y][16" "]":POK
E198,0:WAIT198,1                           ON
•1370 PRINT"[CLEAR]";                      PK
•1380 SC=0:PRINT"[DOWN][s D]O YOU WISH TO
:":PRINT                                   IA
•1390 PRINT"[4" "]1. [s C]ONTINUE TO ENTE
R DATA"                                    NK
•1400 PRINT"[4" "]2. [s C]ONTINUE FROM A
SPECIFIED SET"                             PL
•1410 PRINT"[4" "]3. [s E]DIT SINGLE DATA
 SET"                                      DL
•1420 PRINT"[4" "]4. [s Q]UIT TO [s M]AIN
 [s M]ENU"                                 MN
•1430 PRINT"[DOWN][s Y]OUR [s C]HOICE:";:  FA
•1440 GETA$:IFA$=""THEN1440                EO
•1450 IFA$="1"THENPRINT" 1.":FORT=1TO300:
NEXT:GOTO1790                              EJ
•1460 IFA$="3"THENPRINT" 3.":FORT=1TO300:
NEXT:GOTO1500                              BA
•1470 IFA$="4"THENPRINT" [s M]AIN MENU.":
FORT=1TO300:NEXT:RETURN                    HD
•1480 IFA$="2"THENPRINT:INPUT "[DOWN]WHIC
H SET";O:O=O-1:GOTO800                     FK
•1490 GOTO1440                             CN
•1500 INPUT"[CLEAR][DOWN][DOWN][s W]HICH
SET OF DATA:";N                            NO
•1510 SE=(N-1)*7:BA=NM+SE                  BK
•1520 X=PEEK(BA+1):BA=BA+2:IFPEEK(BA-2)=1
THENX=-X                                   OJ
•1530 Y=PEEK(BA+1):BA=BA+2:IFPEEK(BA-2)=1
THENY=-Y                                   BA
•1540 Z=PEEK(BA+1):BA=BA+2:IFPEEK(BA-2)=1
THENZ=-Z                                   JI
•1550 C=PEEK(BA)                           KC
•1560 PRINT"[CLEAR][3"[DOWN]"][s D]ATA SE
T #"N                                      NK
•1570 PRINT" [s X]="X                      IL
•1580 PRINT" Y="Y                          CL
•1590 PRINT" Z="Z                          CD
•1600 IFC=0THENPRINT" [s B]EGINNING OF LI
NE (0).":GOTO1620                          ML
•1610 PRINT" [s T]HIS IS A LINE (1)."      EP
•1620 C$="":PRINT"[DOWN][s C]HANGE OR [s
L]EAVE ([s C]/[s L]):";                    PF
•1630 GETA$:IFA$=""THEN1630                AA
•1640 IFA$="L"THENPRINT" LEAVE.":FORT=1TO
300:NEXT:GOTO1680                          CD
•1650 IFA$<>"C"THEN1630                    LC
•1660 PRINT" CHANGE."                      HE
•1670 INPUT"[DOWN][s E]NTER NEW VALUES ([
s X],[s Y],[s Z],[s C]):";X,Y,Z,C:GOTO15
60                                         AL
•1680 BA=NM+SE                             KL
•1690 IFX<0THENPOKEBA,1:POKEBA+1,-X:GOTO1
710                                        PK
•1700 POKEBA,.:POKEBA+1,X                  OF
```

```
·1710 BA=BA+2                                EJ
·1720 IFY<0THENPOKEBA,1:POKEBA+1,-Y:GOTO1
 740                                         FP
·1730 POKEBA,.:POKEBA+1,Y                    AC
·1740 BA=BA+2                                GH
·1750 IFZ<0THENPOKEBA,1:POKEBA+1,-Z:GOTO1
 770                                         KE
·1760 POKEBA,.:POKEBA+1,Z:PRINT"[CLEAR][4
 "[DOWN]"]";                                 PH
·1770 IFA$<>"L"THENGOTO1560                  NK
·1780 BA=BA+2:POKEBA,C:GOTO1370              LK
·1790 BA=NM:O=1:PRINT"[DOWN][s N]OW, WHER
 E WERE WE[3"."]"                            EN
·1800 IFPEEK(BA)<>255ANDPEEK(BA+1)<>255TH
 ENBA=BA+1:O=O+1:GOTO1800                    FG
·1810 O=O/7:GOTO800                          KM
·1820 PRINT" [s S]AVE A FILE.":FORT=1TO40
 0:NEXT                                      IN
·1830 PRINT"[CLEAR][CTRL N][RVSON][40" "]
 ";                                          OP
·1840 PRINT"[13" "][s S]AVE A FILE[16" "]
 ";                                          JA
·1850 PRINT"[40" "]"                         KB
·1860 INPUT "[DOWN][s D]ESIRED FILENAME:"
 ;N$                                         PG
·1865 PRINT"[DOWN][s S]AVING[3"."]"          AC
·1870 POKE54272,35:OPEN15,8,1,N$+".3D,S,W
 "                                           NB
·1880 BA=NM                                  CP
·1890 IFPEEK(BA)=255THEN1910                 EF
·1900 PRINT#15,CHR$(PEEK(BA));:BA=BA+1:GO
 TO1890                                      ON
·1910 PRINT#15,CHR$(255)CHR$(255):CLOSE15
 :PRINT"[DOWN][s F]ILE SAVED.":POKE54272,
 0                                           KH
·1915 FORT=1TO500:GETA$:IFA$=""THENNEXT      OI
·1918 RETURN                                 BD
```

LINES

Starting address in hex: C500
Ending address in hex: C83F

***Flankspeed* required for entry! See page 75.**

```
C500: A9 3B 8D 11 D0 A9 08 8D 93
C508: 18 D0 A9 00 8D 00 DD 60 66
C510: A9 1B 8D 11 D0 A9 15 8D 90
C518: 18 D0 A9 03 8D 00 DD 60 79
C520: A9 00 85 FA A9 E0 85 FB 56
C528: A9 00 A2 00 A0 00 91 FA A1
C530: C8 D0 FB E6 FB E8 E0 20 92
C538: D0 F2 A9 10 A0 00 99 00 EF
C540: C0 99 00 C1 99 00 C2 99 52
C548: 00 C3 C8 D0 F1 60 A4 02 9E
C550: 98 29 F8 85 FE 85 FC A9 BB
C558: 00 85 FD 06 FC 26 FD 06 09
C560: FC 26 FD 18 A5 FC 65 FE A0
C568: 85 FC A5 FD 69 00 85 FD 7B
C570: 06 FC 26 FD 06 FC 26 FD BE
C578: 06 FC 26 FD 98 29 07 18 80
C580: 65 FC 85 FC A5 FD 69 00 72
C588: 85 FD 18 A5 FA 29 F8 65 4C
C590: FC 85 FC A5 FB 65 FD 85 9A
C598: FD 18 A9 00 65 FC 85 FC 3D
C5A0: A9 E0 65 FD 85 FD A5 FA B2
C5A8: 29 07 49 07 AA A9 01 CA 49
C5B0: 30 03 0A D0 FA A0 00 A2 FC
C5B8: 34 78 86 01 11 FC 91 FC 89
C5C0: A2 37 86 01 58 60 20 FD F8
C5C8: AE 20 EB B7 8E 02 00 AD 79
C5D0: 14 00 8D FA 00 AD 15 00 30
C5D8: 8D FB 00 20 FD AE 20 EB 3B
C5E0: B7 8E A9 02 AD 14 00 8D 22
C5E8: A7 02 AD 15 00 8D A8 02 8D
C5F0: A9 00 8D AD 02 8D AE 02 16
C5F8: A9 EE 8D 8A C6 8D B7 C6 7C
C600: AD A7 02 38 ED FA 00 8D 06
C608: AA 02 AD A8 02 ED FB 00 F6
C610: 8D AB 02 10 19 A9 00 8D AB
C618: B7 C6 38 A9 00 ED AA 02 13
C620: 8D AA 02 A9 00 ED AB 02 9F
C628: 8D AB 02 4C 40 C6 AD AA 0F
C630: 02 D0 0D AD AB 02 D0 08 44
C638: A9 FF 8D AD 02 8D AE 02 5D
C640: AD A9 02 38 ED 02 00 8D 4F
C648: AC 02 A9 00 E9 00 8D AF C7
C650: 02 10 16 A9 CE 8D 8A C6 CF
C658: A9 00 38 ED AC 02 8D AC 11
C660: 02 A9 00 ED AF 02 8D AF E8
C668: 02 20 32 C7 AD A9 02 CD AB
C670: 02 00 D0 11 AD A7 02 CD 79
C678: FA 00 D0 09 AD A8 02 CD 73
C680: FB 00 D0 01 60 AD AE 02 0D
C688: 10 19 EE 02 00 AD AA 02 FC
C690: 18 6D AD 02 8D AD 02 AD B0
C698: AB 02 6D AE 02 8D AE 02 A2
C6A0: 4C 69 C6 38 AD AD 02 ED A0
C6A8: AC 02 8D AD 02 AD AE 02 F2
C6B0: ED AF 02 8D AE 02 A9 EE 27
C6B8: F0 0B EE FA 00 D0 03 EE 61
C6C0: FB 00 4C 69 C6 38 AD FA 1A
C6C8: 00 E9 01 8D FA 00 AD FB E5
C6D0: 00 E9 00 8D FB 00 4C 69 F9
C6D8: C6 A9 C7 A0 00 99 00 CA 16
C6E0: 99 00 CB C8 D0 F7 A9 00 81
C6E8: 99 41 CB 99 00 CC C8 D0 8F
C6F0: F7 A9 3F 99 81 CC 99 81 D4
C6F8: CD C8 A9 01 99 81 CC 99 BB
C700: 81 CD C8 D0 EC A9 00 99 19
C708: 11 CE 99 A1 CE C8 D0 F7 83
C710: 20 20 C5 20 00 C5 A9 32 D7
C718: 8D 6A C6 A9 C7 8D 6B C6 08
C720: 60 20 20 C5 20 00 C5 A9 16
C728: 4E 8D 6A C6 A9 C5 8D 6B 9D
C730: C6 60 A9 00 8D FD CF A5 02
C738: 17 8D FE CF A5 18 8D FF F6
C740: CF A5 FA 85 17 A5 FB 85 74
C748: 18 A9 CA 18 65 18 85 18 08
```

IMPORTANT! Letters on white background are **Bug Repellent** line codes. **Do not enter them!** Pages 73 and 74 explain these codes and provide other essential information on entering ***Ahoy!*** programs. Refer to these pages **before** entering any programs!

```
C750: A0 00 A5 02 D1 17 B0 09 3B
C758: A9 01 8D FD CF A5 02 91 97
C760: 17 A5 17 18 69 41 85 17 93
C768: A5 18 69 01 85 18 B1 17 F6
C770: C5 02 B0 09 A9 01 8D FD 28
C778: CF A5 02 91 17 A5 02 0A 4A
C780: 85 17 A9 CC 69 00 85 18 9A
C788: A9 81 18 65 17 85 17 90 75
C790: 02 E6 18 A0 01 38 A5 FA 0C
C798: A0 00 F1 17 8D FC CF C8 65
C7A0: A5 FB F1 17 0D FC CF B0 D5
C7A8: 10 F0 0E A9 01 8D FD CF BD
C7B0: A5 FB 91 17 88 A5 FA 91 B5
C7B8: 17 A9 90 18 65 17 85 17 3B
C7C0: A9 01 65 18 85 18 A0 00 27
C7C8: 38 A5 FA F1 17 8D FC CF 05
C7D0: A5 FB C8 F1 17 0D FC CF 1E
C7D8: 90 10 F0 0E A9 01 8D FD AE
C7E0: CF A5 FB 91 17 88 A5 FA 24
C7E8: 91 17 AD FD CF F0 03 20 21
C7F0: 4E C5 AD FF CF 85 18 AD CD
C7F8: FE CF 85 17 60 A2 02 20 89
C800: C9 FF A9 00 20 D2 FF A9 10
C808: 20 20 D2 FF A9 00 85 FB 46
C810: A9 E0 85 FC A0 00 A2 34 94
C818: 78 86 01 B1 FB A2 37 86 26
C820: 01 58 20 D2 FF E6 FB D0 20
C828: 02 E6 FC A5 FB C9 41 D0 8B
C830: E5 A5 FC C9 FF D0 DF 20 53
C838: CC FF 60 00 FF 00 00 00 65
```

PHANTASY
FROM PAGE 18

```
10 COLOR.,1:COLOR4,12:PRINTCHR$(147)CHR$
(11)CHR$(142)CHR$(27)CHR$(77)"[CYAN]STAN
D BY":FORJ=3584TO3968:READI$:POKEJ,DEC(I
$):NEXT                                   JO
20 PRINT"[CLEAR][DOWN]"TAB(17)"[CYAN]C-1
28":PRINT"[DOWN] [PURPLE][c *][RVSON] "; OA
30 PRINT"  [c *][RVSOFF][c *][RVSON] [RV
SOFF] [c *][RVSON] [RVSOFF] [RVSON][sEP]
  [c *][RVSOFF][c *][RVSON] [c *][RVSOFF
] [c *][RVSON] [sEP][3" "][c *][sEP]  [c
 *][sEP]  [c *][RVSOFF][c *][RVSON][c *]
[RVSOFF] [RVSON][sEP][RVSOFF][sEP]";      KN
40 PRINT"  [RVSON] [RVSOFF]  [RVSON] [RV
SOFF] [RVSON] [RVSOFF]  [RVSON] [RVSOFF]
 [RVSON] [RVSOFF]  [RVSON] [RVSOFF] [RVS
ON] ";                                    AJ
50 PRINT"[RVSOFF][c *][RVSON][c *][RVSOF
F] [RVSON] [RVSOFF][sEP] [RVSON] [RVSOFF
] [c *][RVSON] [RVSOFF]  [RVSON]  [RVSOF
F][4" "][c *][RVSON] [RVSOFF][sEP]"       NN
60 PRINT"  [CYAN][RVSON][3" "][RVSOFF][s
EP] [RVSON][4" "][RVSOFF] [RVSON][4" "][
RVSOFF] [RVSON] [RVSOFF] [c *][RVSON][c
*] [RVSOFF]  [RVSON] [RVSOFF]  [RVSON][4
" "][RVSOFF][c *][RVSON]  [c *][RVSOFF]
 [RVSON] "                                GE
70 PRINT"  [RVSON] [RVSOFF][4" "][RVSON]
 [RVSOFF]  [RVSON] [RVSOFF] [RVSON] [RVS
OFF]  [RVSON] [RVSOFF] [RVSON] [RVSOFF]
 [c *][RVSON] [RVSOFF]  [RVSON] [RVSOFF]
  [RVSON] [RVSOFF]  [RVSON] [RVSOFF][3"
"][RVSON] [RVSOFF]  [RVSON] "             AN
80 PRINT"  [PURPLE][RVSON] [RVSOFF][4" "
][RVSON] [RVSOFF]  [RVSON] [RVSOFF] [RVS
ON] [RVSOFF]  [RVSON] [RVSOFF] [RVSON] [
RVSOFF][3" "][RVSON] [RVSOFF]  [RVSON] [
RVSOFF]  [RVSON] [RVSOFF]  [RVSON] [RVSO
FF][3" "][RVSON] [RVSOFF]  [RVSON] "      LN
90 PRINT"[RIGHT][RVSON][sEP][RVSOFF][sEP
][3" "][RVSON][sEP][RVSOFF][sEP] [RVSON]
[sEP][RVSOFF][sEP][RVSON][sEP][RVSOFF][s
EP] [RVSON][sEP][RVSOFF][sEP][RVSON][sEP
][RVSOFF][sEP] ";                         FA
100 PRINT"[RIGHT][RVSON][sEP][RVSOFF][sE
P] [RVSON][sEP][RVSOFF][sEP] [RVSON][sEP
][RVSOFF][sEP] [RVSON][sEP][RVSOFF][sEP]
[RVSON][sEP]  [RVSOFF][sEP] [RVSON][sEP]
[RVSOFF][sEP]"                            FO
110 PRINTTAB(19)"[DOWN][DOWN]BY":PRINTTA
B(10)"[DOWN]CLEVELAND M. BLAKEMORE":PRIN
TTAB(12)"[DOWN][DOWN][CYAN]FOR AHOY! MAG
AZINE":CHAR,16,23,"[c 7]DREAMING[3"."]"   GN
120 REM INITIALIZE VARIABLES              LD
130 CLR:DIM J,X,Y,C,U,M,T,R,D,L,K,F,P,B,
Z,G,Q,V,S,I,RX,RY,R1,R2,DF,I$,J$          KF
140 DIM R(2,2,19),K$(2,2,5),P(39):RESTOR
E740:GOSUB470:FORJ=.TO7:READI,C:POKE2040
+J,I:POKE53248+39+J,C:NEXT:FORJ=.TO38STE
P2:P(J)=170:P(J+1)=140:NEXT               DK
150 FORL=1TO5:FORJ=.TO2:FORI=.TO2:READK$
(I,J,L):NEXTI,J,L                         AJ
160 P=2040:B=56:Z=.:U=1:M=2:T=5:G=15:R=4
5:K=129:Q=360:F=.:V=53248:DF=96           AI
170 MOVSPR8,192,164:MOVSPR7,110,164:MOVS
PR6,150,164:POKEV+27,254                  FH
180 DEFFNL(J)=(X>12ANDX<334ANDY>38ANDY<2
38)                                       GJ
190 I$="[BLUE][c A][s C][c S][DOWN][3"[L
EFT]"][c 7]":J$="[3"[LEFT]"][BLUE][s B][
RIGHT][s B][DOWN][3"[LEFT]"][c Z][s C][c
 X]"                                      HF
200 FORX=1TO5:CHAR.,1+X*6,19:PRINTI$;X;J
$:NEXT:CHAR,12,23,"CHOOSE SKILL LEVEL"    IG
210 L=1:C=.:DO:IFL<>CTHENCHAR.,1+L*6,19:
PRINT"[RVSON]"I$;L;J$:C=L:FORX=.TO30:NEX
T                                         JI
```

```
·220 IFJOY(2)=3THENL=L+1+(L=5)*5                DB
·230 IFJOY(2)=7THENL=L-1+(L=1)*-5               CF
·240 IFC<>LTHENCHAR.,1+C*6,19:PRINTI$;C;J
$:FORX=.TO30:NEXT                               PL
·250 LOOPUNTILJOY(2)>127:PRINT"[CLEAR]"         CC
·260 MOVSPR1,200,160:SPRITE1,.,15:RX=2:RY
=2                                              MA
·270 GOSUB520                                   CI
·280 FORJ=.TO10:C=BUMP(U):C=BUMP(U):C=BUM
P(M):C=BUMP(M):NEXT:POKEV+21,PEEK(V+21)O
R1OR(RX<>MORRY<>M)*-((L>U)*-8+16):D=U+(L
>M)*-M                                          PG
·290 REM MAIN LOOP                              BN
·300 DO:X=RSPPOS(U,.):Y=RSPPOS(U,U):A=JOY
(M):J=AANDG:IFJTHENMOVSPRU,T;(J-U)*R:Z=-
(Z=.):POKEP,B+Z                                 AG
·310 MOVSPRM+M+RND(.)*M,RND(.)*Q#D:C=BUMP
(M):IF(CANDU)THENMOVSPRU,X,Y                    BL
·320 C=BUMP(U):LOOPUNTILFNL(.)=.OR(CANDU)
:ON-(FNL(.))+UGOTO380,330                       EK
·330 IFC=9ORC=17ORC=25THENCHAR,13,10,"[WH
ITE]C [RED]A [CYAN]P [PURPLE]T [GREEN]U
[BLUE]R [YELLOW]E [c 1]D":POKEV+21,PEEK(
V+21)AND254:SOUND1,30000,200,1,100,100,.
:SLEEP5:POKEV+21,.:RUN20                        CN
·340 IF(C=3ORC=5)ANDF=.THENF=U:POKEV+21,P
EEK(V+21)AND249:SOUND1,25000,5:K$(RX,RY,
L)="":C=BUMP(U):C=BUMP(U):GOTO300:ELSEIF
C=3ORC=5THEN300                                 DK
·350 IF(C=33ORC=65)ANDFTHENSOUND1,8000,10
,1,100,900,.:F=.:POKEV+21,PEEK(V+21)AND(
255-(CAND254)):DF=DFAND(255-(CAND254)):C
=BUMP(U):C=BUMP(U):GOTO300                      GB
·360 IFC=33ORC=65THENMOVSPRU,X,Y:MOVSPRU,
+T,+.:C=BUMP(U):C=BUMP(U):SOUNDU,P*M,U,,
,,3:GOTO300                                     CM
·370 IFC=KTHENCHAR,14,10,"[WHITE]E [RED]S
 [CYAN]C [PURPLE]A [GREEN]P [BLUE]E [YEL
LOW]D [c 1]!":POKEV+21,PEEK(V+21)AND254:
SOUND1,20000,200,2,2000,8000,2:SLEEP5:PO
KEV+21,.:RUN20:ELSE300                          AB
·380 POKEV+21,.:MOVSPR4,.#.:MOVSPR5,.#.         PF
·390 P((RX+1)*(RY+1)*4)=RSPPOS(4,.):P((RX
+1)*(RY+1)*4+1)=RSPPOS(4,1)                     AC
·400 P((RX+1)*(RY+1)*4+2)=RSPPOS(5,.):P((
RX+1)*(RY+1)*4+3)=RSPPOS(5,1)                   KD
·410 IFX=<12THENRX=RX-U+(RX=.)*-3:MOVSPR1
,330,Y                                          CO
·420 IFX=>334THENRX=RX+U+(RX=M)*3:MOVSPR1
,16,Y                                           EB
·430 IFY=<38THENRY=RY-U+(RY=.)*-3:MOVSPR1
,X,233                                          KJ
·440 IFY=>238THENRY=RY+U+(RY=M)*3:MOVSPR1
,X,43                                           DN
·450 GOTO270                                    NI
·460 REM READ ROOM DATA IN                      HH
·470 FORRY=.TO2:FORRX=.TO2:J=.                  EB
·480 READR1,R2:IFR1=.THEN500                    CM
·490 R(RX,RY,J)=R1:R(RX,RY,J+1)=R2:J=J+2:
GOTO480                                         NB
·500 NEXT:NEXT:RETURN                           OP
·510 REM DRAW ROOM SCREEN IN RX,RY              GD
·520 PRINT"[BLUE][CLEAR]":J=.                   BH
·530 R1=R(RX,RY,J):R2=R(RX,RY,J+1):IFR1=.
THEN570                                         AM
·540 S=1:IFR2-R1>40THENS=40                     CI
·550 FORI=R1TOR2STEPS:POKEI,160:NEXT            NN
·560 J=J+2:GOTO530                              NN
·570 IFRX=UANDRY=MTHENPOKEV+21,128              FA
·580 IFRX=MANDRY=MTHENPOKEV+21,DF               NL
·590 MOVSPR4,P((RX+1)*(RY+1)*4),P((RX+1)*
(RY+1)*4+1)                                     GG
·600 MOVSPR5,P((RX+1)*(RY+1)*4+2),P((RX+1
)*(RY+1)*4+3)                                   KE
·610 IFK$(RX,RY,L)>""THENI$=K$(RX,RY,L):M
OVSPR(VAL(LEFT$(I$,1))),VAL(MID$(I$,2,3)
),VAL(MID$(I$,5,3)):SPRITE(VAL(LEFT$(I$,
1))),1,8:J=FRE(U)                               IP
·620 RETURN                                     PM
·630 REM SPRITE DATA                            BB
·640 DATA 0,,,,,,,,,,,,,,,78,,,78,,,78,,
1,FE,,3,FF,,6,FD,80,3,79,80,,7B,,,FC,,,C
C,,,CC,,1,CC                                    OM
·650 DATA 0,,C,,,E,,,,,,,,,,,,,,,,,,,,,,
,,78,,,78,,,78,,1,FE,,3,FF,,6,FD,80,6,7B
,80                                             LJ
·660 DATA 3,78,,,FC,,,CC,,,CC,,,CE,,,C0,,
1,C0,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,0             BI
·670 DATA 0,,1,C0,,1,7F,C0,1,C1,40,,,,,,,
,,,,,,,,,,,,,,,,,,,,,,,2,,40,5,,A0,A,8
1                                               GJ
·680 DATA 50,2,42,40,2,24,40,1,E7,80,,18,
,78,,1C,84,3C,23,98,42,19,A0,BD,9,98,,79
,86,,81,B1,,71,AE,,9,A0,,12,9C,,24,42,,1
8,3C,,,0                                        CL
·690 DATA 0,,,,,,,,,,,,1,F0,,E,E,,9,F2,,9
,12,,9,F2,,8,2,,F,FE,,C,1,,A,,80,9,FF,C0
,8,80,20,C,40,10,A,20                           BJ
·700 DATA 8,1,10,4,,8F,FE,,48,2,,28,2,,1F
,FE,,10,2,,1F,FF,F8,10,,8,17,FF,E8,14,,2
8,14,,28,14,,28,14,3C,28,14,7E,28,14,7E,
28,14,3C,28                                     DO
·710 DATA 14,18,28,14,3C,28,14,7E,28,14,,
28,14,,28,14,,28,14,,28,14,,28,17,FF,E8,
10,,8,1F,FF,F8,,0                               DF
·720 REM ROOM DATA                              LC
·730 REM ROOM1                                  ND
·740 DATA 1049,2009,1190,1200,1190,1430,1
304,1310,1624,1633,1393,1993,1393,1418          PK
·750 DATA 1402,2002,1418,1778,,0                AE
·760 REM ROOM2                                  PA
·770 DATA 1033,1393,1044,1404,1450,1463,1
638,1663,1637,1997,,0                           GG
·780 REM ROOM3                                  AE
·790 DATA 1039,1639,1624,1638,1424,1438,1
320,1343,1652,1663,1684,2004,,0                 OB
```

```
•800 REM ROOM4                                      CH
•810 DATA 1033,1193,1184,1192,1042,1242,1
 049,1249,1384,1393,1433,1993,1402,1423             BI
•820 DATA 1442,2002,1722,1738,,0                    NL
•830 REM ROOM5                                      EM
•840 DATA 1037,1197,1197,1223,1384,1397,1
 397,1757,1757,1764,1764,2004,1405,1423             BF
•850 DATA 1770,1783,,0                              CM
•860 REM ROOM6                                      FB
•870 DATA 1184,1223,1044,1164,1384,1404,1
 444,2004,1553,1564,1593,1993,1744,1753             EP
•880 DATA 1410,1423,1450,2010,,0                    HK
•890 REM ROOM7                                      HG
•900 DATA 1033,1353,1042,1362,1363,1383,1
 409,2009,1570,1583,1704,1722,,0                    CE
•910 REM ROOM8                                      JJ
•920 DATA 1044,1364,1365,1383,1344,1353,1
 393,1993,1544,1552,1564,1583,1604,2004             AC
•930 DATA 1725,1743,,0                              HK
•940 REM ROOM9                                      LO
•950 DATA 1033,1353,1344,1352,1544,1564,1
 044,1544,1050,1730,1704,1743,1759,1999             DJ
•960 DATA 0,0                                       NH
•970 REM SPRITE POINTERS & COLORS                   PN
•980 DATA 56,14,58,7,58,8,59,13,59,13,61,
 4,61,4,60,3                                        PD
•990 REM KEY LOCATIONS                              PP
•1000 REM LEVEL 1                                   CO
•1010 DATA "",,3107148,,2175092,,,,""               DH
•1020 REM LEVEL 2                                   CF
•1030 DATA "",,,,2068152,,,3151130,""               EI
•1040 REM LEVEL 3                                   FL
•1050 DATA "",,,3151170,,,,2151160,""               JI
•1060 REM LEVEL 4                                   FO
•1070 DATA "",,,,,,2272190,,3089208                 OE
•1080 REM LEVEL 5                                   IF
•1090 DATA "",,,,,2047194,3186067,,""               IA
```

THE EXTRACTOR

FROM PAGE 61

Starting address in hex: 0801
Ending address in hex: 0FFF
SYS to start: RUN

***Flankspeed* required for entry! See page 75.**

```
0801: 19 08 0A 00 9E 32 30 37 64
0809: 35 3A 54 48 45 20 45 58 18
0811: 54 52 41 43 54 4F 52 00 32
0819: 00 00 A5 01 29 FE 85 01 6E
0821: A9 0E 20 D2 FF A9 93 20 29
0829: D2 FF A0 00 AD F6 0F 8D DD
0831: 86 02 99 00 D8 99 00 D9 9F
0839: 99 00 DA 99 00 DB C8 D0 BC
0841: F1 AD F7 0F 8D 21 D0 AD 15
0849: F8 0F 8D 20 D0 20 F0 0D ED
0851: A9 01 85 60 20 66 0C A5 1A
0859: C6 85 CC 8D 92 02 F0 F7 7D
0861: 78 A5 CF F0 0C A5 CE AE 6F
0869: 87 02 A0 00 84 CF 20 13 1B
0871: EA 20 B4 E5 A4 60 D9 C6 BC
0879: 0F F0 05 88 10 F8 30 D7 18
0881: 85 62 A9 08 48 A9 57 48 AC
0889: 98 0A A8 B9 D7 0F 48 B9 77
0891: D6 0F 48 60 A5 59 85 FA 9F
0899: A5 5A 85 FB 20 76 0D D0 8F
08A1: 07 A9 0F 85 60 20 F0 0D 65
08A9: A9 93 20 D2 FF A9 01 85 0A
08B1: 64 A9 00 85 58 A0 FF C8 07
08B9: B9 1C 0F F0 05 20 D2 FF 87
08C1: D0 F5 20 E4 FF F0 FB C9 44
08C9: 31 90 F7 C9 35 B0 F3 85 AC
08D1: 63 C9 32 D0 28 A0 FF C8 93
08D9: B9 8A 0F F0 05 20 D2 FF 16
08E1: D0 F5 20 E4 FF F0 FB C9 64
08E9: 31 90 F7 C9 3A B0 F3 20 6C
08F1: D2 FF 38 E9 30 8D 70 09 1E
08F9: A9 0D 20 D2 FF A9 52 85 25
0901: 5F 20 C7 0B 20 CC FF A2 E2
0909: 08 20 C6 FF 20 CF FF A4 8C
0911: 63 C0 34 D0 2A C9 2E F0 4D
0919: 0F C9 3F F0 0B C9 21 F0 09
0921: 07 C9 20 F0 0A A0 01 2C DA
0929: A0 02 84 64 4C 36 09 A4 E4
0931: 64 F0 09 C6 64 C9 0D D0 62
0939: 31 4C CB 09 4C DC 09 C9 87
0941: 0D D0 27 A4 63 C0 31 D0 11
0949: 03 4C CB 09 C0 32 D0 0C 3D
0951: A4 61 F0 05 C6 61 4C CB 8D
0959: 09 4C DC 09 A4 61 08 A0 43
0961: 00 84 61 28 F0 64 A9 20 8E
0969: D0 08 C9 20 F0 04 A0 02 C3
0971: 84 61 38 C9 20 90 64 C9 38
0979: 40 90 16 C9 60 90 0C C9 F0
0981: 80 90 0B C9 A0 90 54 C9 B6
0989: C0 B0 06 38 E9 20 38 E9 65
0991: 20 29 7F 85 57 A4 58 91 C5
0999: FA A4 58 C0 27 F0 04 E6 55
09A1: 58 D0 38 A0 00 84 58 A5 26
09A9: 90 F0 02 D0 32 20 76 0D D3
09B1: 20 84 0D 90 12 20 68 0D 9B
09B9: A0 00 B9 1F 0E F0 06 20 58
09C1: D2 FF C8 D0 F5 F0 25 4C 86
09C9: 0D 09 A9 7A A4 58 91 FA 8D
09D1: C0 27 F0 CF C8 A9 20 91 9E
09D9: FA D0 F5 A5 90 F0 0A C9 96
09E1: 40 F0 09 20 34 0C 4C E1 AA
09E9: 0A 4C 0D 09 20 34 0C A9 60
09F1: 93 20 D2 FF 20 1C 0D 20 E1
09F9: 0A 0D 20 13 0D 20 C2 0C 40
0A01: A9 13 20 D2 FF A9 00 85 DF
0A09: 5D A9 01 85 5E 60 20 D3 49
0A11: 0D A9 93 20 D2 FF A9 57 4F
0A19: 85 5F 20 C7 0B 20 25 0D 43
0A21: 20 CC FF A2 08 20 C9 FF A2
0A29: A0 FF C8 C0 28 F0 29 B1 47
```

```
0A31: FC 10 F7 29 7F C9 7A D0 F3
0A39: 08 A9 0D 20 D2 FF 4C 59 90
0A41: 0A C9 20 90 09 C9 40 90 69
0A49: 09 C9 60 90 03 18 69 20 B1
0A51: 69 20 20 D2 FF 4C 2B 0A 4F
0A59: 20 44 0D 90 02 B0 06 20 34
0A61: 5A 0D 4C 29 0A 20 34 0C A8
0A69: A9 93 20 D2 FF 20 95 0C 5B
0A71: 60 A5 5D 49 01 85 5D 20 22
0A79: E7 0C 20 91 0D 60 A5 5E 90
0A81: 49 01 85 5E 20 E7 0C 20 E3
0A89: 91 0D 60 20 66 0C 60 20 9B
0A91: 13 0D 4C 99 0A 20 25 0D F3
0A99: 20 BD 0A A6 62 E0 54 D0 90
0AA1: 07 20 4F 0D 90 09 B0 0D 7C
0AA9: 20 44 0D 90 02 B0 06 20 84
0AB1: 5A 0D 4C 99 0A 20 D3 0D 0A
0AB9: 20 95 0C 60 A0 FF C8 C0 06
0AC1: 28 F0 1C B1 FC A6 62 E0 8F
0AC9: 58 F0 0D A6 5E D0 05 29 24
0AD1: 7F 4C DB 0A 09 80 D0 02 DF
0AD9: 49 80 91 FC 4C BF 0A 60 A8
0AE1: 20 0A 0D 20 13 0D 20 C2 3C
0AE9: 0C A9 13 20 D2 FF 60 20 26
0AF1: 2E 0D 90 01 60 20 68 0D B4
0AF9: A5 D6 C9 00 D0 0A 20 66 A1
0B01: 0B 20 00 0D 20 E7 0C 60 AD
0B09: A9 91 D0 1B 20 39 0D 90 27
0B11: 01 60 20 76 0D A5 D6 C9 5C
0B19: 17 D0 0A 20 88 0B 20 00 DE
0B21: 0D 20 E7 0C 60 A9 11 20 7D
0B29: D2 FF 20 E7 0C 60 20 D3 64
0B31: 0D A2 17 20 39 0D B0 06 15
0B39: 20 76 0D CA 10 F5 20 95 63
0B41: 0C 60 20 D3 0D A2 17 20 88
0B49: 2E 0D B0 16 20 68 0D CA AB
0B51: 10 F5 20 13 0D 20 AD 0C 71
0B59: A5 FD C9 10 90 04 20 95 21
0B61: 0C 60 4C E1 0A A9 07 85 3C
0B69: AD A9 97 85 AC A0 00 B1 DC
0B71: AC A0 28 91 AC A5 AC D0 48
0B79: 09 A5 AD C9 04 D0 01 60 D5
0B81: C6 AD C6 AC 4C 6E 0B A9 D8
0B89: 03 85 AD A9 FF 85 AC E6 82
0B91: AC F0 0D A5 AC C9 98 D0 C1
0B99: 09 A5 AD C9 07 D0 03 60 FA
0BA1: E6 AD A0 28 B1 AC A0 00 FD
0BA9: 91 AC 4C 90 0B 20 2E 0D 2B
0BB1: B0 0F 20 68 0D 20 1C 0D 50
0BB9: 20 76 0D 20 F3 0D 4C 53 1E
0BC1: 0B 68 68 4C 1B 08 A9 80 37
0BC9: 20 90 FF A0 00 B9 08 0E EA
0BD1: F0 06 20 D2 FF C8 D0 F5 4B
0BD9: A0 00 20 CF FF C9 0D F0 32
0BE1: 06 99 00 02 C8 D0 F3 98 A9
0BE9: F0 E1 A9 0D 20 D2 FF C0 27
0BF1: 11 90 15 A0 00 B9 0F 0E 20
0BF9: F0 06 20 D2 FF C8 D0 F5 73
0C01: 20 E5 0D 68 68 4C 55 08 8E
0C09: A9 2C 99 00 02 C8 A9 53 40
0C11: 99 00 02 C8 A9 2C 99 00 E4
0C19: 02 C8 A5 5F 99 00 02 C8 4D
0C21: 98 A2 00 A0 02 20 BD FF DC
0C29: A9 08 AA A8 20 BA FF 20 29
0C31: C0 FF 60 20 CC FF A5 BA 9F
0C39: 20 B4 FF A9 6F 85 B9 20 86
0C41: 96 FF A9 0D 20 D2 FF 20 A1
0C49: A5 FF C9 0D D0 F6 20 D2 80
0C51: FF 20 AB FF 20 E5 0D A9 D9
0C59: 08 20 C3 FF A9 0F 20 C3 E1
0C61: FF 20 CC FF 60 20 D3 0D AF
0C69: A9 93 20 D2 FF A9 0D 20 70
0C71: D2 FF A0 FF 20 A2 0C C8 7C
0C79: B9 2F 0E F0 10 C9 0D D0 19
0C81: 06 20 D2 FF 4C 75 0C 20 68
0C89: D2 FF 4C 78 0C 20 E4 FF 32
0C91: C9 00 F0 F9 20 13 0D 20 A6
0C99: AD 0C 20 DC 0D 20 C2 0C 4C
0CA1: 60 A2 07 A9 1D 20 D2 FF 65
0CA9: CA 10 F8 60 A4 5B 88 30 96
0CB1: 0F A5 FC 38 E9 28 85 FC 30
0CB9: A5 FD E9 00 85 FD D0 EE 8A
0CC1: 60 A9 00 85 D1 A9 04 85 56
0CC9: D2 A0 00 B1 FC 91 D1 C0 10
0CD1: BF D0 0A A5 D2 C9 07 D0 86
0CD9: 04 20 91 0D 60 C8 D0 EB 82
0CE1: E6 FD E6 D2 D0 E5 A5 5D 3A
0CE9: F0 14 A0 27 B1 FA A6 5E 68
0CF1: F0 03 09 80 2C 29 7F 91 D5
0CF9: FA 91 D1 88 10 EE 60 A0 E0
0D01: 27 B1 FA 91 D1 88 10 F9 CA
0D09: 60 A9 00 85 FA A9 10 85 D2
0D11: FB 60 A5 FA 85 FC A5 FB 32
0D19: 85 FD 60 A5 FA 85 59 A5 22
0D21: FB 85 5A 60 A9 00 85 FC 89
0D29: A9 10 85 FD 60 A9 10 C5 46
0D31: FB 90 04 A9 00 C5 FA 60 8C
0D39: A5 FB C5 5A 90 04 A5 FA 30
0D41: C5 59 60 A5 FD C5 5A 90 15
0D49: 04 A5 FC C5 59 60 A5 FD 13
0D51: C5 FB 90 04 A5 FC C5 FA 0B
0D59: 60 A5 FC 18 69 28 85 FC 88
0D61: A5 FD 69 00 85 FD 60 A5 F7
0D69: FA 38 E9 28 85 FA A5 FB D0
0D71: E9 00 85 FB 60 A5 FA 18 F5
0D79: 69 28 85 FA A5 FB 69 00 96
0D81: 85 FB 60 A5 FB CD FB 0F DD
0D89: 90 05 A5 FA CD FA 0F 60 F7
0D91: 20 D3 0D A0 27 A9 20 99 BD
0D99: C0 07 88 10 FA AD F9 0F AB
0DA1: 8D 86 02 18 A2 18 A0 0A 35
0DA9: 20 F0 FF A5 5D D0 04 A0 33
0DB1: 00 F0 0A A5 5E F0 04 A0 46
0DB9: 11 D0 02 A0 1D B9 9C 0F C0
0DC1: F0 06 20 D2 FF C8 D0 F5 3B
0DC9: 20 DC 0D AD F6 0F 8D 86 9B
```

```
0DD1: 02 60 38 20 F0 FF 86 5B 5F
0DD9: 84 5C 60 18 A6 5B A4 5C 36
0DE1: 20 F0 FF 60 A9 00 85 A2 25
0DE9: A5 A2 29 80 F0 FA 60 20 48
0DF1: 0A 0D A9 20 A0 27 91 FA 27
0DF9: 88 10 FB 20 76 0D 20 84 D6
0E01: 0D 90 EF 20 0A 0D 60 0D 33
0E09: 4E 41 4D 45 3A 00 0D 4E C0
0E11: 41 4D 45 20 54 4F 4F 20 18
0E19: 4C 4F 4E 47 0D 00 54 45 F0
0E21: 58 54 20 41 52 45 41 20 28
0E29: 46 55 4C 4C 0D 00 74 68 47
0E31: 65 20 65 78 74 72 61 63 40
0E39: 74 6F 72 0D 0D 4D 41 52 8A
0E41: 4B 49 4E 47 3A 0D 6D 20 40
0E49: 4D 41 52 4B 2F 55 4E 4D 95
0E51: 41 52 4B 0D 6F 20 54 55 76
0E59: 52 4E 20 6D 20 4F 4E 2F 74
0E61: 4F 46 46 0D 40 20 41 4C 38
0E69: 4C 20 54 45 58 54 0D 78 A1
0E71: 20 45 58 43 48 41 4E 47 91
0E79: 45 0D 74 20 54 4F 50 20 74
0E81: 54 4F 20 43 55 52 53 4F D2
0E89: 52 0D 65 20 43 55 52 53 AC
0E91: 4F 52 20 54 4F 20 45 4E AA
0E99: 44 0D 0D 43 55 52 53 4F 85
0EA1: 52 3A 0D 66 20 46 4F 52 A9
0EA9: 57 41 52 44 20 4F 4E 45 DB
0EB1: 20 53 43 52 45 45 4E 0D A0
0EB9: 62 20 42 41 43 4B 20 4F BD
0EC1: 4E 45 20 53 43 52 45 45 E8
0EC9: 4E 0D 68 6F 6D 65 20 54 44
0ED1: 4F 50 20 4F 46 20 54 45 E0
0ED9: 58 54 0D 0D 72 20 52 45 CA
0EE1: 41 44 0D 61 20 41 50 50 D7
0EE9: 45 4E 44 0D 77 20 57 52 10
0EF1: 49 54 45 0D 64 20 44 45 EF
0EF9: 4C 45 54 45 20 54 4F 20 09
0F01: 45 4E 44 0D 0D 3F 20 44 96
0F09: 49 53 50 4C 41 59 20 54 51
0F11: 48 49 53 20 53 43 52 45 44
0F19: 45 4E 00 52 45 41 44 49 13
0F21: 4E 47 2F 41 50 50 45 4E 5B
0F29: 44 49 4E 47 20 46 49 4C 48
0F31: 45 0D 0D 31 2E 20 52 45 A7
0F39: 41 44 20 55 4E 43 48 41 4F
0F41: 4E 47 45 44 0D 32 2E 20 ED
0F49: 53 54 52 49 50 20 45 58 9A
0F51: 54 52 41 20 52 45 54 55 9A
0F59: 52 4E 53 0D 33 2E 20 53 2F
0F61: 54 52 49 50 20 4C 49 4E A5
0F69: 45 20 52 45 54 55 52 4E B0
0F71: 53 0D 34 2E 20 53 54 52 4E
0F79: 49 50 20 45 58 54 52 41 B8
0F81: 20 53 50 41 43 45 53 0D 6F
0F89: 00 0D 4B 45 45 50 20 48 25
0F91: 4F 57 20 4D 41 4E 59 3F CD
0F99: 20 3E 00 4D 41 52 4B 49 6D
0FA1: 4E 47 20 44 49 53 41 42 BB
0FA9: 4C 45 44 00 20 20 20 20 FF
0FB1: 4D 41 52 4B 49 4E 47 00 BC
0FB9: 20 20 20 55 4E 4D 41 52 9E
0FC1: 4B 49 4E 47 00 52 3F 41 BE
0FC9: 4F 4D 40 58 57 46 42 54 33
0FD1: 45 44 91 11 13 A1 08 8B 46
0FD9: 0A 94 08 71 0A 7E 0A 95 1A
0FE1: 0A 95 0A 0E 0A 2E 0B 42 1F
0FE9: 0B 95 0A 8F 0A AD 0B EF D6
0FF1: 0A 0C 0B E0 0A 01 00 00 FE
0FF9: 02 00 D0 00 FF 00 FF CC
```

TIPS AHOY!

Continued from page 52

```
169, 4, 170, 160, 7, 32, 186, 255
•4065 DATA  32, 192, 255, 162, 4, 32, 201
, 255, 169, 147, 32, 121, 239, 32, 134
•4080 DATA  3, 32, 226, 80, 169, 0, 141,
0, 255, 169, 4, 32, 74, 255, 96, 0
•4085 PRINT:PRINT"LLIST ADDED TO BASIC 7.
0. LLIST
•4090 PRINT"PERFORMS LIST TO PRINTER. USE
S THE SAME
•4095 PRINT"FORMAT AS BASIC 7.0 'LIST' ST
ATEMENT.
•4100 PRINT:PRINT"FORMAT: [RVSON]LLIST [F
IRST LINE] [-LAST LINE]
•4105 PRINT:PRINT"SET PRINTER TO TOP OF P
AGE PRIOR TO
•4110 PRINT"EXECUTION. LLIST WILL AUTOMAT
ICALLY
•4115 PRINT"SKIP PERFORATIONS BETWEEN PAG
ES.":NEW
```

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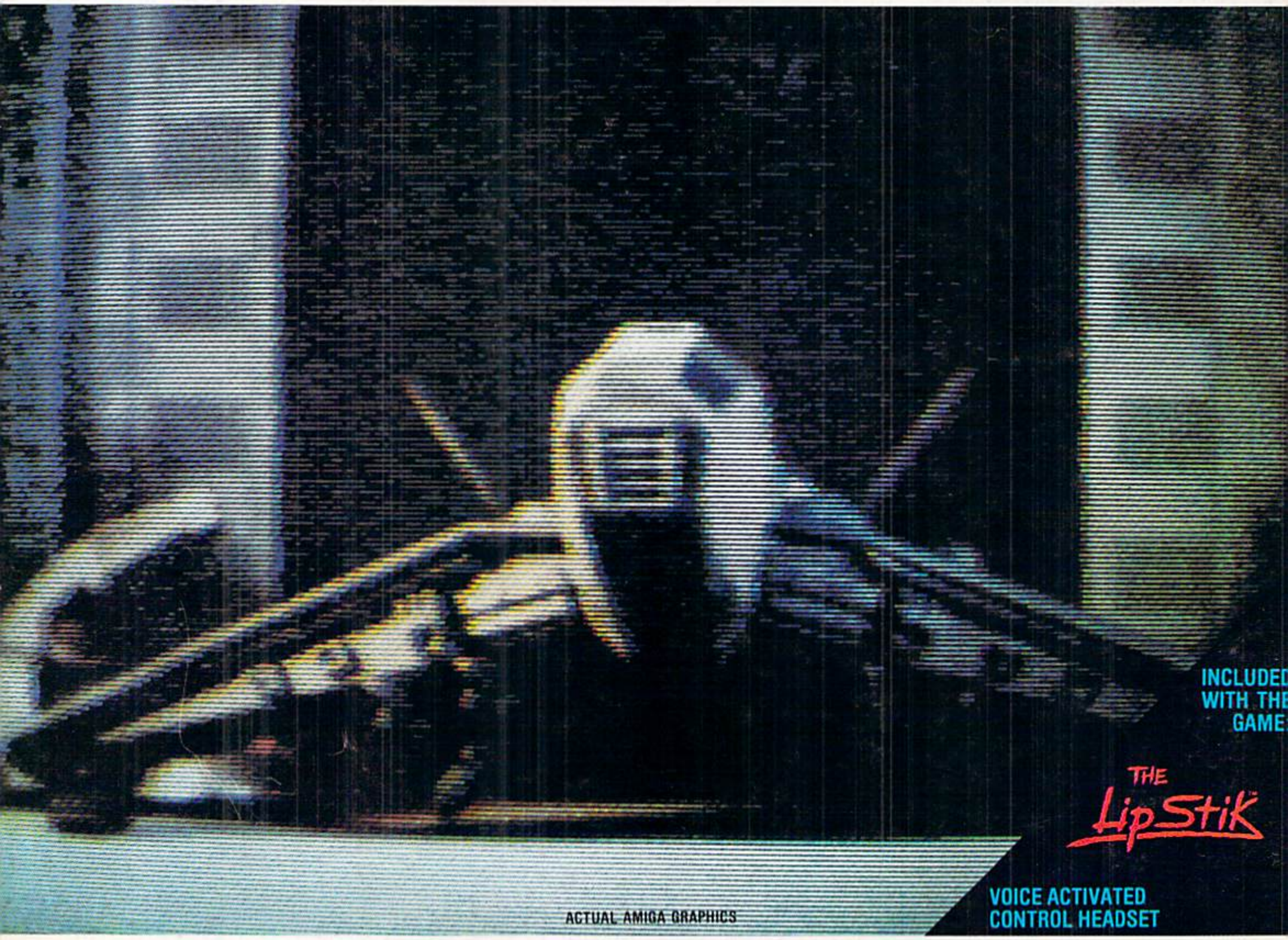
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